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# FIRST ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD

OF THE

## CITY OF LYNN,

FOR THE YEAR ENDING DECEMBER 31, 1872.

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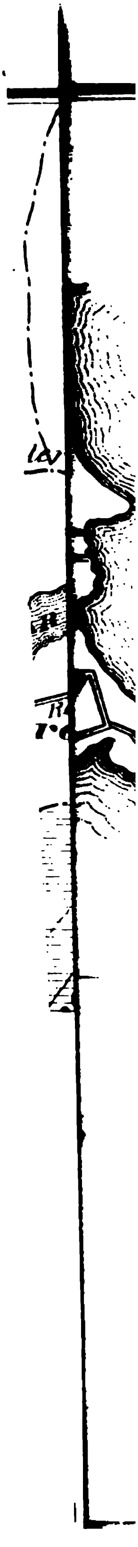

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# ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD.

The Public Water Board herewith present to the City Council their Annual Report for the year 1872. The "Ordinance for the Regulation of the Water Supply of the City" requires of the Board "a full report of all their official acts and doings for the year preceding" its presentation. In compliance with this requirement, we submit a statement of the receipts and expenditures for the year, the present condition of the works, and such information relating to the introduction of water into the city as will be necessary to inform the two branches of the City Council of the success that has attended the undertaking, and the wants of the department for the coming year.

Immediately following the election of a member of the Board in January last, an organization was effected by re-electing to their several positions the officers of the previous year. The positions of Clerk of the Board and of Superintendent of the Works have been filled by one appointee, who, with an assistant, has also discharged the duties of Water Registrar. The official who has been charged with this variety of service has satisfactorily performed the work entrusted to his care, and it affords us pleasure to allude to him as a reliable and competent officer. The duties of these several positions will not be materially increased during the coming year, and therefore but little additional expenditure for office work will become necessary.

The construction of elaborate and costly water works by municipal corporations is usually placed in charge of a board of commissioners, whose term of office continues until all the works designed for the obtaining and supplying of water have been completed. The execution of the plans for the introduction of water into our own city has proceeded differently, having been entrusted to committees of the City Council, and, subsequent to their election, to the Public Water Board. The City Government for 1869 having had its attention directed to the inadequate supply of water for the extinguishment of fires, so plainly manifest at the destructive conflagrations which had but just occurred, petitioned the Legislature for authority to take the water of Humphrey's Pond or Flax Pond as a source of supply. The City Council having designated the latter as the more desirable, the act obtained from the Legislature was submitted to the people for their acceptance. The failure of the friends of the measure to command an affirmative vote on the question presented, suggested to the City Council the expediency of bringing to the city a sufficient supply of water for the uses of the Fire Department only. For this purpose a temporary arrangement was made with the party controlling the flow of Flax Pond, for the laying of water pipes from that source to the centre of the city. An expenditure of thirty-two thousand dollars was authorized for the laying of the street mains and for the setting of the required number of gates and hydrants. Before the close of the year the work was accomplished, and the most important business streets were made secure against a short supply of water in case of fires.

The City Government for 1870, acting upon the belief that the rejection by the people of the water act of the previous year was from lack of sufficient information as to the quantity and quality of water that Flax Pond would furnish, and from the want of even approximate estimates of the cost of introducing it, authorized a survey of the ponds and water sources in this vicinity. Among those which received attention was Breed's Pond. This basin presents a water surface of about fifty acres, and receives the flow of several small brooks gathered from a water shed of a little less than a square mile. As the immediate demand for water was for manufacturing and fire purposes, rather than for domestic use, and as a further supply from Flax Pond could not be obtained without paying to its proprietor a large percentage of the water rents, or buying his interest in the pond and its flow at a price to be determined by a wearisome and vexatious process of law, the small mill privilege at Breed's Pond, together with the land and buildings connected therewith, was purchased. To make this source available the dam was partially rebuilt, a gate-house erected, and a twelve-inch main laid to the west end of the Common, there connecting with a ten-inch pipe laid through North Common Street to its junction with Franklin Street, at which point a connection was made with the mains laid from Flax Pond the previous year. The total expenditure for bringing this supply to the city proper, including the purchase of the mill property and all water rights belonging thereto, was a little more than sixty thousand dollars.

During the fall of this year the Committee on Water Supply, in answer to sundry petitions, reported in favor of laying additional water-pipes in certain streets of the city, for the purpose of affording a better protection to property and for supplying, to a limited extent, water for domestic use. Although at the time of purchasing Breed's Pond the water flowing into it was not considered sufficiently pure for culinary or drinking purposes, an analysis showed it to be not only much purer than the well waters which had been tested, but freer from impurities than any pond or river water, — excepting only Sluice

Pond,—from which a supply could be brought to the city. It was therefore decided to allow its use for all purposes, and, upon application being made to the Committee, service pipes were put into factories, stores and dwelling-houses, to the number of fifty during the months of November and December As the altitude of the pond when full would be but sixty-two feet above mean high tide, in order to provide a sufficient supply of water in the more elevated portions of the city and to make effective the hydrants there located, a small engine was purchased and placed in the factory building at the pond. The pumps were connected with the supply main, and a pressure upon the pipes was obtained, in working hours, sufficient to ensure a full service at all points to which pipes had been laid. During the night time, except in case of fire, the supply has been that which gravitation alone would furnish. This method of supplying the city has been continued to the present time, but will soon be supplanted by using the distributing reservoir at Pine Hill. The expenditure for the additional pipes, the laying of which was not completed until the spring of 1871, was twenty-seven thousand six hundred dollars, and for the engine and its connection, seven thousand eight hundred dollars. During the month of November the water from Flax Pond was shut off, the accumulation in Breed's Pond being sufficient to supply the city. At the close of the year the water at the dam was nine feet in depth.

A slight fire on Union Street, occuring on the 10th of December, occasioned the first draught upon it for the extinguishment of fire.

The City Government for the year 1871, perceiving that the measures already adopted for the introduction of water were favorably regarded by a large majority of the people, and believing that a more general distribution would meet with favor, petitioned the Legislature for authority to issue water bonds, and for a grant of powers to enable the city to further prosecute the work. An act entitled "An Act for the Supplying of the City of Lynn with Pure Water" was passed, and the authority prayed for granted. Although the proceedings in regard to the purchase of Breed's Pond were doubtless conformable to law, to set at rest the criticism of a few, the legalization of the purchase was provided for in the Water Act. By this act the city was authorized to issue three hundred thousand dollars in twenty-year bonds.

On the first of May the pond had become full and was wasting over the weir. The Committee on Introduction of Water reported favorably on a large number of petitions asking for an extension of the water-pipes, and the City Council appropriated one hundred and seventy-five thousand dollars for that purpose. One hundred and twenty-five thousand dollars were also appropriated for the building of a reservoir, the erection of an engine house, the purchase of a pumping engine and boilers, and the setting of the same upon the proper foundations. A contract for the laying of distribution pipe, including the furnishing and setting of fire hydrants and gates, with all the necessary air-cocks, blow-offs and branches to complete this part of the work, was awarded to Mr. George H. Norman, of Newport, R.I., for the sum of one hundred and seventy thousand dollars ; the contractor agreeing to hold the city harmless from all damages to persons or property on account of the prosecution of the work, to remove all ledge encountered without extra charge, and to receive his pay in six-per-cent. twenty-year city bonds at par ; and further agreeing to keep the works in good condition for the term of three years without charge.

The streets in which the pipes were to be laid were those designated in the Engineer's Report, the list embracing the central and populous portions of the city. Work was immediately commenced and prosecuted with much vigor. Although the amount of distribution mains contracted for seemed large, and was thought by many as unnecessary to meet the public want, the City Council was soon in receipt of petitions from every section of the city for their extension; and during the year there were added to the original contract sixty thousand feet of the various sizes of pipe, and a corresponding number of hydrants and gates. The total expenditure under the above-named contract during the year was two hundred and eighty-four thousand seven hundred and forty-nine dollars. Service pipes were also laid to many dwellings and business places, and the year closed with fourteen hundred and twenty water-takers.

The building of the reservoir at Pine Hill was commenced about the first of May of that year. The work was at first undertaken by the city, and placed in charge of Mr. George H. Bishop, the Engineer employed upon the works. The rugged character of the ground selected — strewn with boulders and overgrown with bushes and trees—made the labor at first difficult. The clearing of the grounds was scarcely completed, when the Committee under whose direction the work had proceeded discovered a want of public confidence in the undertaking. Embarrassed by the statements of incompetent judges, as to the cost of constructing so ample a reservoir upon so unpromising a site, the Committee determined to relieve the over-cautious from their fears, and themselves from unfavorable comment, by contracting for its completion for a specific sum. In June the work was undertaken by Mr. Norman, who contracted to perform the labor, furnish all necessary material for its construction, and pay all bills incurred by the city on account of the same, for the sum of seventy thousand dollars. The obstacles which, to inexperienced eyes, appeared so formidable, were quickly displaced under his skilful management, and hundreds of tons of rock, beyond the quantity required for the interior slopes of the embankment, were removed. The hard blue gravel which underlay the soil, seemingly impervious and almost defying the efforts of the laborers to remove it, was to form the embankments. The grounds seemed almost covered with men and teams. But before winter set in the excavation was completed, the embankments were made, the slopes were laid with stone, the gate-house erected, and the force and distribution mains laid through the embankments. The labor required to finish and properly grade the top and exterior slopes only remained to be performed.

While the laying of the distribution pipes and the building of the reservoir were being carried forward, Mr. Norman was employed to furnish and lay the pumping main from the engine-house to the reservoir and the distribution main which connects the reservoir with the pipes on Walnut Street. The direction given to these lines of pipe necessitated a cutting through solid ledge for a considerable distance, and to a depth varying from six to sixteen feet. The work proceeded slowly, and was not finished until June of the following year. The expenditure for this portion of the works, including the necessary gates and connections, was about twenty-three thousand dollars.

The Committee on Water Supply for the year 1871 also contracted with Mr. Norman for furnishing the

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city with the pumping engine and boilers, and the placing of the same upon substantial foundations. The capacity of the engine was to be equal to the delivery of two million gallons of water into the reservoir in ten hours. The contract was for the entire machinery, in complete running order, and the engine and boilers were guaranteed to be equal to the required tests as set forth in the specifications.

On the 12th of July the "Ordinance Regulating the Water Supply of the City" was passed by the City Council, and a board of officers, entitled the "Public Water Board of the City of Lynn," was elected under its provisions on the twentieth of the same month. On the 3d of August the members of the Board met for organization, immediately following which the Committee on Introduction of Water, under whose direction the orders of the City Council had been executed, were relieved from their duties, and the "charge, superintendence and oversight of all structures, works, arrangements and apparatus designed and provided for the obtaining and supplying of pure water for the uses of the city," were transferred to the newly elected Water Board.

The foregoing brief history of the introduction of water into our city, in the absence of any connected statement of the progress of the works from year to year, seems properly to make a part of this our First Annual Report. Although not narrated with that

h might seem desirable, the impor-
ing to the undertaking are believed
ly set forth to serve the purpose for
ere brought together, namely: that the
Water Board may contain, substantially,
of the inception and development of the
public interest placed under their care.

ort report submitted to the City Council a
, although designated as the "Annual Report
Water Board" in the City Documents, was not
rly such. But five months had elapsed since
election, and that intimate knowledge of the
es which the positions to which they had been
cted impose, which alone would authorize a full
port, had not then been acquired. The experience
the past year, and a better understanding of the
uestions connected with a public water supply, enable us to give at the present time a more particular report of the condition of the works, the progress made during the year, and the results obtained.

At the time of the election of the Board, the various parts of the works, excepting only the engine-house, had been contracted for, and much progress had been made. Of their several divisions we report as follows: —

## DISTRIBUTION PIPES.

The entire length of the distribution pipes laid in the city is between forty-one and forty-two miles, nearly all of which is of the kind known as the wrought-iron and cement pipe. The sizes vary from four to sixteen inches in diameter. The larger portion was laid in 1871, there having been laid in the two previous years but a little more than six miles.

The number of hydrants set is three hundred and twenty-seven, sixty-eight having been added during the year; and the whole number of gates two hundred and eighty-three, an increase of fifty-eight for the year. This department of the works is reported by the superintendent to be in good condition, and showing faithful work on the part of the contractor.

The extension of the pipes during the past year has been greater than the Board thought necessary, the amount being but little less than nine miles. We would respectfully suggest that all petitions for further extensions be referred directly to the Water Board for decision, or that the Committee of the City Council charged with their consideration be requested to confer with them upon the expediency of granting the prayer of the petitioners. A rule adopted in other cities, which seems to us a reasonable one, requires that such petitions shall be accompanied with such number of applications for water as will ensure an income from water-rents on new lines of pipe equal, at least, to the interest upon the cost of the extension. The only exception to this rule which seems to us allowable is the extension of pipes to neighborhoods which are in need of water for the extinguishment of fires. For the coming year, if this rule be followed, but a small amount of pipe will be required, as the main streets of the city and almost every important neighborhood are already accommodated.

## FORCE AND SUPPLY MAINS.

The laying of the force and supply mains was completed in June last. They have been tested during the present winter, and no important leaks were found. The slight ones discovered will be repaired in the spring at the expense of the contractor. These mains are a little less than two thousand feet in length, and are in part only of the kind laid as distribution pipes. They are much heavier than the street pipes and are doubtless capable of sustaining the pressure which a full service will bring upon them when the distribution of water is made from the reservoir.

## SERVICE PIPES.

The number of service pipes put in the past year was seven hundred and twenty-four, the whole number on the first of January being two thousand one hundred and ninety-four. Applications for water continue, and the number of takers during the coming year will doubtless be considerably increased. The expenditure for the past year on this portion of the works was about eleven thousand dollars, and the total outlay, including the bills for 1870 and 1871, has been about forty thousand dollars. All the supply pipes laid by the city are of iron, lined with cement, and are believed to be the safest conductors of water in use, being free from liability to oxidation and from the supposed harmful effects communicated to water when drawn through long lengths of lead or galvanized iron pipes. The unusually severe weather of the winter of 1872 deprived some of the water-takers, for a season, of a supply, the services in some exposed localities having been frozen up. In all cases where ready access could be had, the pipes were thawed out, and the inconveniences of an interrupted supply removed. To avoid the liability of freezing, the services put in the past year have been laid to a depth of four and a half feet, six inches deeper than those previously laid.

## ENGINE HOUSE.

One of the first duties devolving upon the Water Board after their election was the obtaining of plans for an engine house. Those accepted were presented by N. J. Bradlee, Esq., of Boston, architect, and for some years President of the Cochituate Water Board. Proposals were issued, and the contract for the erection of the building was awarded to Amos B. Drown, Esq., of this city. The foundations for the building and the chimney were put in by Messrs. Stewart, Snow & Co., by the day, the stone for the walls being obtained from the reservoir grounds. Ground was broken for the laying of the foundations in September, 1871, and the work was continued until the close of the year. The walls are deep laid, of good thickness, and were built with much care. The erection of the house was commenced early the following spring, and is now nearly completed. The requirements of the contract have been faithfully performed, and the plans of the architect closely followed.

The building is divided into an engine-room, fifty by fifty-six feet; boiler-room, forty by forty-six feet; and coal-room, forty-one by forty-six feet. The main well-room in the basement is forty feet in length, ten feet four inches in width, and thirteen feet in depth. Connected with this is the pump well, ten by six, by thirteen feet. The walls of the well-rooms are of granite, lined with brick and covered with cement. The chimney is one hundred and twenty feet high, octagonal in form, and rests upon solid masonry sixteen feet in depth.

The building is of face brick, with trimmings of Concord granite, having handsome cornices of galvanized iron, painted in imitation of granite. The walls of the engine-room are plastered and finished below the windows in ash. The ceiling is sheathed and handsomely grained in oak. The general appearance of the house is attractive, and when the grounds about it are graded and properly cared for, it will be an ornament to our city. The expenditure required to erect and properly furnish it will be about fifty thousand dollars.

In view of the fact that this important public building is located just on the edge of the thickly settled portion of the city, and upon one of the highways which connects our city with some of the adjoining towns,—to be, with the pumping machinery it is to contain, the visible representative of the water-works of the city, a point of attraction to our citizens and of interest to strangers,—the large expenditure made to erect it seems to your Board justifiable.

The site for the engine house contains about seventy thousand square feet of land, and has a frontage of two hundred feet on Walnut Street. Its cost was five thousand six hundred and sixty dollars. By the terms of conveyance the grantors are required to lay out on either side of the lot streets fifty feet in width, the expense of grading them to be borne by the city. The grounds are favorably situated for the location of the pumping works, being but a short distance from the reservoir, and at an elevation which will allow of the delivery into the pump-well, by gravitation, the water of any of the sources which have been considered with reference to a larger supply.

## ENGINE AND BOILERS.

The pumping machinery, including foundations, was furnished under contract with Mr. George H. Norman, and consists of a Compound Beam and Fly-Wheel Engine, with a "Thames Ditton" or bucket and plunger pump. It is built on a novel plan, designed and patented by E. D. Leavitt, Jr., of Cambridge, and was constructed by I. P. Morris & Co., of the Port Richmond Iron Works, Philadelphia. The chief peculiarity of the engine consists in the arrangement of the steam cylinders, which are located under the beam centre and incline outwardly, so that their pistons are connected to opposite ends of the beam, and in consequence move in opposite directions at the same time. By this arrangement the steam passages connecting the cylinders are made short and direct, being (it is claimed) not more than one-fourth of the average length of similar passages in the ordinary form of compound engines. The connection of the pistons to opposite ends of the beam reduces the strain on that member of the engine at least fifty per cent., and affords an opportunity for connecting the pump to one end and the crank to the other end of the beam in such a manner that the least amount of space is occupied by the engine, while at the same time there is complete accessibility to all the parts. The stroke of both steam pistons, pump bucket and throw of the crank, are also made equal, which is said to be an impossibility in other plans of compound beam engines. The valves and valve-gear are arranged in such a manner as to distribute the steam with the best economy and at the same time be free from liability to wear and derangement. The pump has an improved supplementary discharge pipe and valves, by which it is claimed that a greater speed of the engine is rendered practicable without the increased friction due to passing all the water through the necessarily contracted opening of the pump-bucket; and as an illustration of the value of this part of the invention, it may be here stated that the engine has been run at twenty-six revolutions per minute under the full load, and that this speed can be maintained if necessary, thus increasing the pumping capacity fifty per cent. beyond that guaranteed by the contractor. The general arrangement of the framing and other parts of the engine is such as to secure great strength and solidity with a minimum amount of material. The dimensions of the engine and pump are as follows: —

| | | |
|---|---|---|
| Diameter of high-pressure cylinder, | 17½ | inches. |
| " " low-pressure cylinder, | 36 | " |
| " " working barrel of pump, | 26⅛ | " |
| " " plunger, | 18½ | " |
| " " fly-wheel, | 26½ | feet. |
| Length of stroke of steam and water-pistons, | 7 | " |
| Revolutions per minute, | 18 | |

Capacity at above revolutions (5,000,000) five million gallons in twenty-four hours.

The speed of the engine is regulated by a ball governor and is accurately controlled. The duty guaranteed by the contractor is sixty million pounds of water pumped one foot high by one hundred pounds of coal, and the results thus far obtained give promise that this duty will be largely exceeded. Steam is supplied by two plain horizontal tubular boilers, each five feet in diameter of shell, and containing seventy-seven tubes of three inches outside diameter and sixteen feet long, with a steam drum three feet in diameter and six feet high.

## RESERVOIR.

The reservoir at Pine Hill, including the embankments, covers an area of about nine acres. Its interior surface is a little less than five acres and its depth is eighteen feet. The water-line is fixed at the height of fifteen feet, and the capacity of the reservoir at this point is equal to twenty millions gallons. The top and exterior slopes of the embankment are yet to be finished, no further work upon them having been deemed advisable until the reservoir has been filled and its serviceableness determined. The force main enters it at the bottom of the gate-house, and is twenty inches in diameter, being laid in the same trench as the distribution mains which are to supply the city. A duplicate supply main, sixteen inches in diameter, is also laid, to connect with another line of distribution pipes whenever the wants of the city may require their use. The elevation of the reservoir is about one hundred and sixty-two feet above mean high tide, and when filled to the water-line the surface of the water will be one hundred and seventy-seven feet above that point. Its location is distant about two miles from the centre of the city by the line of pipe.

Within a few weeks the reservoir has been partially filled, and we regret to report that this test of its tightness shows it to be at present almost unserviceable. The trial of the pumping engine was continued for a little more than a week, and during this time nearly two millions of gallons of water a day were delivered into the reservoir. For the first few days no loss of water was apparent, but when the accumulation was considerable, and a depth of eleven feet was indicated, the subsidence was marked. A close observation, after the pump had stopped working, showed that the loss was according to the head of water in the reservoir; for as that diminished, the waste in any given number of hours was correspondingly small. As the subsidence was continuous until nearly all the water pumped into the reservoir was wasted, and as no leakage through the embankments could be discovered, the inference is that the connection of the pipes with the gate-house or with the embankments is imperfect, the leak allowing the passage of water to an underground opening, which conducts it to the surface many rods away.

Perhaps as probable an explanation of the defect may be suggested by assuming that the leakage is through the bottom. It has rarely been thought safe to rely upon the natural bed of an excavation for imperviousness to water. The hard, compact material found at the bottom, which suggested the uselessness of artificial means to prevent waste, may have misled those entrusted with the care of its construction, and the escape may be by filtration through the ground, the water reaching the ledge a short distance below the bottom, and finding its outlets through fissures in the rock or by following the dip of the ledge till it reaches the surface of the ground. If the first explanation shall be found to be correct, the remedy can be quickly and easily applied. But if the latter shall prove true, the remedy will be by covering the bottom and that portion of the slopes made by the excavation with a puddle of clay and gravel to the depth of two feet. In either case nothing can be done until the ice and snow are melted away and the opportunity is furnished to observe carefully the surroundings and the banks of the reservoir. Meantime the reservoir will be partially filled, and the supply to consumers and in case of fire will be from that source, pumping such additional quantity from the waste of the pond as will supply the loss by leakage. To the members of the Water Board not less than to our citizens generally does this disappointment come; for they had felicitated themselves upon the good fortune that had attended the prosecution of the work, and hoped, through the medium of this report, to congratulate their fellow-citizens upon the substantial completion of the Water Works of the city.

The reservoir grounds comprise about seventeen acres of rough pasture land, and include a strip two rods in width, extending from the reservoir, in a south-easterly direction, to land of Thomas Woodfall. Through this belt of land the force and supply mains, which connect the well-chamber at the engine house with the reservoir, are in part laid. From this point to Walnut Street the pipes are laid in land of Thomas Woodfall and Abner Hill, a right of way only having been obtained.

The reservoir grounds were appropriated by an order of the City Council, passed July 26, 1871, a failure to negotiate with the owners making such action necessary. By ,an arrangement between the parties in interest, the question of the value of the land, and all incidental questions arising from the taking of the same by the city, were submitted to a Board of Reference, who reported their decision in December last By the terms of settlement thus obtained, the city was required to pay two hundred and eighty-three dollars and thirty-three cents an acre, or a gross sum, including that portion of the expense of the reference to be paid by the city, of five thousand two hundred dollars.

Included in these grounds is the bold and sharplyoutlined hill-top lying southerly from the reservoir. Its elevation is two hundred and thirty feet above high tide, and is forty feet higher than High Rock. From its summit, in a clear day, the Wachuset and Monadnock Mountains are distinctly visible, while to the southward a large part of the city proper is immediately in view. Boston Harbor, with its islands and shipping, Nahant and its beaches, the church-spires of Boston and Chelsea, the Monument at Charlestown and the beautiful village of East Saugus, are all brought prominently before the eye at this pleasant and attractive spot. The city is indeed fortunate in possessing so fine a lookout at so moderate a cost; and when the reservoir is fully completed, its slopes turfed, and the projected roads to furnish easy access to its grounds are constructed, this locality will become one of the most attractive of the many pleasant resorts our city affords.

## WATER SUPPLY.

In submitting a report of the condition of the Water Works of the city, the Water Board would not regard their duty as fully discharged if they failed to make prominent mention of the water source from which the city is at present supplied. In presenting the results of our observation, and the facts bearing on the adequacy of the present supply, we desire also to discuss briefly the question of a further supply and the sources from whence it should come.

A water supply should be abundant in quantity, and in quality so unexceptionable that its use, for any purpose, shall be wholly serviceable to consumers. If from more than one source such a supply can be obtained, the other important consideration has reference to the relative cost of possessing them and conducting their waters to the point from which the distribution is to be made. Taking for granted the correctness of the proposition submitted, we invite the attention of the City Council, first, to a consideration of the question, Have we an adequate supply?

Lynn has an estimated population of thirty thousand. The inception of the plan for a general water supply dates back but two years. During that time twenty-two hundred service-pipes have been applied for and put in. As will be seen by the report of the Clerk of the Water Board (hereto appended), twenty-five hundred families obtain more or less of their daily supply of water from Breed's Pond. One hundred and fifteen shoe and morocco factories and thirty-seven steam engines are connected with it; while the total number of takers, for other than domestic uses, is three hundred and twenty. For all the purposes for which water is used the usual per capita rating is sixty gallons daily. On the first day of January there were twenty-eight hundred and five water-takers. Assuming that each taking represents five persons, and that the consumption of water in Lynn is equal to that in other places, the quantity used at the present time cannot be much less than eight hundred thousand gallons daily. The Report of the Superintendent of the works states that, "from careful estimates, we are now supplying about seven hundred thousand gallons a day." As this estimate is based upon the discharge from the pumps of the engine at each stroke of the pistons, after deducting a proper percentage for loss of duty, it may be regarded as nearly accurate. We conclude, then, that the present daily consumption of water in our city is between seven and eight hundred thousand gallons. Of the whole number of services supplied, seven hundred and twenty-four were put in during the past year. If there should be added only four hundred during the year 1873, the quantity of water used will probably be increased, at the close of the year, one hundred and twenty-five thousand gallons a day, making the aggregate daily consumption at that time not less than eight hundred and fifty thousand gallons. It is also to be borne in mind, that when the distribution is made from the reservoir, the supply will be uninterrupted, and abundant to every section of the city to which pipes have been laid, and that the pressure upon them will greatly increase the liability to waste and an excessive use.

Having determined with sufficient accuracy the probable demand for water during the year, we invite attention to the source of supply. The watershed of Breed's Pond is a little less than a square mile The average yearly rainfall in eastern Massachusetts is forty-two inches. In a year affording this amount there will fall upon the territory draining into Breed's Pond about seven hundred and thirty million gallons, or two million gallons a day, calling the watershed a full square mile. The tables of engineers show that from thirty to sixty per cent. of the rainfall is collectable and can be stored. If we assume that the larger percentage can be collected in Breed's Pond, on account of the steep and rugged character of its watershed, the average daily quantity collected will be but twelve hundred thousand gallons. But of the quantity stored there is a loss by evaporation during the year equal to the rainfall upon the surface of the pond, and by some engineers is estimated as high as fifty-four inches. As the surface of the pond is fifty acres, this loss, if we include the waste by leakage from the pipes and the evaporation from the surface of the water in the reservoir, must be equal to two hundred thousand gallons daily. Under the most favorable circumstances, therefore, the present supply of water cannot be rated above a million gallons a day, showing a probable surplus above consumption of one hundred and fifty thousand gallons. But this quantity depends upon the realization of a rainfall for the year equal to the full average for a series of years, a nowise certain reliance. If a drouth as severe as those of 1870–71 should visit us the coming season, the entire supply would be required; for as drouth prevails the demand for water increases. For watering streets, gardens and lawns, the quantity used would be many times that supplied the past year. Wells would again become dry, and the resort of those who now depend on them will be to the public water supply. Nor is such a contingency so remote that it need not be provided for. The unusual rainfall of the past year, which filled to overflowing the pond, should not be regarded as showing the capacity of our source of supply any more than the seasons of drouth which preceded it. It is the *liability* to a short supply that we should provide against; and we close our remarks upon this branch of the subject by suggesting that a water supply which, *in its minimum yield*, is not surely abundant, cannot be regarded as competent, and hazards the welfare of the community it was intended to protect.

Having shown the insufficiency of the present water source, we will attempt an answer to the question, From whence shall a further supply come? But two sources have been prominently considered, namely, Flax Pond and its tributaries, and Saugus River. These were made the subject of a report by the engineer who conducted the water surveys of 1870. During the past year the engineer employed

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probable surplus above consumption of one h
and fifty thousand gallons. But this quant
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Pond) will make the storage reservoirs, the capacity of which will be seven hundred millions of gallons, equal to the entire rainfall in a year upon the watershed of Breed's Pond. The quantity of water which these sources will furnish would seem to be ample for many years, and sufficient for a population larger than the most hopeful of our citizens expect our city to contain within the present century. But plans for the future, in thriving communities, are not usually sufficiently comprehensive, and are quickly outgrown. It is important, therefore, in making provision for a further supply of water, that the source taken shall be fully adequate to meet any expected demand in the future, or so related to other sources that it can be connected with them without sacrificing the outlay which must be made to secure it This advantage is obtained in the plan proposed. But a short distance above Hawkes' Brook, and at a height which will readily conduct the water to the ponds below, flows Saugus River. If the future wants of the city should require a larger supply than that provided for in the report presented, it will then be at hand, and can be inexpensively diverted. The supply, therefore, in this direction, is undoubted in quantity, and can be made available as the growth of the city and the requirements of the surrounding towns, which may depend upon us for a supply, require.

In this connection we ask attention to some of the reasons which may be urged for a large and abundantly adequate supply. There are situated upon our borders three thriving and prosperous townships, two of them already before the City Council, by petition, asking the terms upon which a partial supply can be obtained. But few towns, favorably situated, will much longer deny themselves the convenience and security to property afforded by a public water supply. Those towns that do will soon find that such neglect places a check upon their growth, and that their relative importance in the community of townships is lessening. Situated as our city is,—with elaborate works constructed, and our water mains already reaching the boundaries of the adjacent towns,—no supply should be considered as ample which is not sufficient, in addition to our present and prospective wants, to meet the demands of our neighbors. Expensive works will not be by them constructed, and only by means of the works in this city will they be accommodated. These towns were formerly parts of our own municipality, and in their growth and importance our advancement and welfare is, to some extent, involved. To be able to supply them so reasonably as to induce the taking, will be mutually beneficial; placing within their reach a great convenience, and a protection to property not otherwise obtainable; and they, in return, paying therefor such sufficient remuneration as will assist in extinguishing the debt incurred in constructing the works

We have said that the quality of the water supplied should be so unobjectionable as to meet the requirements of consumers. Will the sources we have been considering furnish such a supply? The water of Breed's Pond has been in constant use for the past two years, and at the present time is supplied to nearly ten thousand persons. While its use has encountered the prejudices which a change from the cooler and more sparkling well waters, however impure, always incites, those who have been its constant users bear willing testimony to its purity and its adaptation to all the purposes for which water is required. We regard, however, the analysis to which it has been subjected* as more satisfactory than any mere opinion that has been expressed, as such a test of its quality determines with scientific accuracy both the amount and the character of the impurities which it contains.

The waters of Birch and Penny Brooks are gathered from a territory of the same hilly and rocky character as that which surrounds Breed's Pond, and when stored in the proposed reservoirs, and time allowed for the precipitation of the floating particles taken along in their course, will be as pure and as satisfactory as the water from that source. The only objection to the waters of these three sources is the reddish color imparted to them by contact with vegetable growths. This, we are assured, will gradually disappear. The clearing of the brooks, and the removal of such obstacles as intercept the ready flow of water into them, would much assist in rendering these waters clear and colorless, while the action of the sun and winds upon so broad a surface as these ponds will present, will greatly aid in removing this only objectionable quality. We are led to this conclusion by comparing water taken from the brook which mainly feeds Sluice and Flax Ponds, with that taken from those ponds themselves. A specimen from the brook was found to be more deeply colored than the water of Breed's Pond, while the change resulting from storage is shown by the clear and almost colorless appearance of these waters as they are discharged through their outlets below.

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* See Water Report of 1870 for analyses of various pond and well waters in this vicinity.

The largest of these streams is Hawkes' Brook. Its rise is at Nell's Pond, and drains in its course the southerly portion of the town of Lynnfield and the northerly part of the town of Saugus, joining its flow with that of Penny Brook near the junction of Walnut Street with the Newburyport Turnpike, in Saugus. The water from this brook is comparatively white and clear, and is gathered from a territory nearly free from the swamps and lowlands which make so considerable a part of the watershed of the ponds in this vicinity. No separate analysis of these waters has been obtained, but as they are apparently clearer than the water of Saugus River, to which they are tributary, we conclude that when stored they will be equal in quality to the present supply from Breed's Pond.

The choice of the city in providing a further supply of water lies in taking either Saugus River or some of its tributaries, or Flax Pond and the system of ponds connected with it. The former having been considered, we will briefly speak of the latter. The watershed of Flax Pond and its tributaries is about two and a half square miles. Assuming that there can be collected and stored in this series of ponds as large a percentage of the annual rainfall as we have allowed to be collectable in Breed's Pond, a daily average of three million gallons can be secured. As the surface of these ponds is one hundred and twenty acres, the evaporation in a year will amount to one hundred and fifty million gallons, or nearly a half million a day. The quantity, therefore, which may be had from this source, even if the storage of the large percentage of rainfall assumed should prove true, can be but two and a half millions a day. It is, however, claimed that the yield of these ponds is much larger than would be indicated by the size of the watershed belonging to them, and that they are fed by springs and water veins, which convey to them a portion of the rains falling upon a territory not included in their own. The existence of underground currents we do not question, but to determine from whence they are gathered and where discharged are questions of much difficulty. If, by actual tests, the discharge of these ponds had been proved to be greater than the collectable rainfall upon the territory draining into them, we could accept the statement of those who put forward the claim; but in the absence of such proof, and with some facts in our possession going to disprove the pretence, we choose to rely upon the rules adopted by engineers in judging the value of these sources as a water supply for our city. And, further, since no satisfactory test has been resorted to to prove an unusual flow from these ponds, or that their yield is equal to the expected quantity to be gathered from the territory surrounding them, it might be required of those who advocate the taking of these sources to show that no underground currents convey away to some other pond or water-course a portion of the rainfall which annually falls upon their watershed; for if subterranean sources are to be considered, in the absence of any proof to the contrary, any particular source is as likely to lose as to gain by these underground currents.

It has also been suggested that catch-water drains can be cut, which will bring to these lakes an increased quantity of water. But a little reflection will show how impracticable would be such an attempt. To increase the present supply, the territory naturally draining in some other direction must be reached. On the north and east of the Flax Pond system is Brown's and Spring Ponds. These are the property of the Salem Aqueduct Company, and supply in part the city of Salem and the town of Peabody. On the north and west is Humphrey's Pond, which furnishes the water power to the factory at Brookdale, and Saugus River and its tributaries, which supply the power to the woolen mills at Saugus Centre No diversion of water from these sources could be made without damages, and probably an injunction would prevent any change of direction to their natural flow without legislative action.

If, then, the city should avail itself of the privilege granted by the Legislature of 1872, and Flax Pond should be added to our present source, we could safely rely on a supply of three and a half million gallons a day. If the City Council shall consider that quantity sufficient for the present and future wants of the city, the power to possess it is with them. It is not for us to direct, but to follow the directions of those with whom the people have entrusted their interests.

. The remarks submitted upon the question of a further supply relate mainly to the quantity required. The incidental questions connected with the discussion we purposely avoid, leaving their consideration to those whose attention will be called to them when the important matter we have considered is fully presented. We close this part of our report by urging upon the attention of the City Council the necessity of a further supply, and trust that an early consideration of the matter may be accorded. In the opinion of the Board, the present season should not pass by without increasing our supply; and if the suggestions herein presented are not thought practicable or advisable, we shall most willingly follow any other plan which we may be instructed to pursue.

## COST OF THE WORKS.

The report of the Clerk of the Board furnishes in detail the expenditure on account of the construction of the works, and includes in the statement all outlays for the introduction of water, from the inception of the undertaking in 1869 to the close of the year 1872. At the latter date the construction account showed an expenditure of a little less than seven hundred thousand dollars. A payment of twelve thousand five hundred dollars on the engine contract, and one of eleven thousand dollars on the contract for the building of the reservoir, will become due the present year. When all the works are fully completed, the entire expenditure will amount to seven hundred and twenty-five thousand dollars. Any further outlay that will increase the construction account, will arise from the extension of the works and from adding to our present supply of water.

## RECEIPTS.

The income from water-rents for the past year was thirty-seven thousand dollars. This sum, however, includes the collections for the first half year, commencing with October, 1871, which amounted to about nine thousand dollars, leaving as the receipts for the year twenty-eight thousand dollars. No allowance, however, for hydrant service has been made by the city, but so reasonable an appropriation we trust will not be withheld in the future. With the increase in the number of takers which may reasonably be expected during the coming year, we hope to realize an income nearly, if not quite, sufficient to meet the interest on the water debt and the current expenses of the department.

We are not aware of any place where a public water supply has been provided, that has, at so early a date after the construction of the works, received so large an income on the expenditure, or where the outlay has brought to the tax-payers a lighter burden.

## CONCLUSION.

In presenting this report, we congratulate our fellow-citizens upon the success which has attended the introduction of water into the city, and upon the advantages now enjoyed by the community in having at all times and for all purposes an abundant supply of water. Especially would we congratulate the owners of real estate, and those whose capital is invested in the business interests of the city, on the greatly increased security to property thus furnished. With hydrants located at all favorable points, supplied from a source so elevated as to give to each almost the effectiveness of our steam fire engines, the facility with which our well organized fire department can now control any fire,—happening under no peculiarly unfavorable circumstances, — may well relieve the community from the anxious apprehensions of disastrous conflagration which have been so long felt.

In closing, we would acknowledge our obligations to Mr. George H. Bishop, the engineer employed on the works from their commencement, for the faithful discharge of his duties and the willingness with which he has imparted all necessary information. Under his supervision all the works have been constructed, and his services have given that satisfaction which comes from the employment of one who brings to his calling competency and integrity.

To those who have been entrusted with the prosecution of the work, and to whom contracts have been awarded, we would also express our thanks for the faithful performance of all obligations assumed. The construction of all the works, except the engine-house, has been carried on under contracts made with Mr. George H. Norman, of Newport, R.I. First employed by the city in 1869, in laying the pipes from Flax

Pond, his services have been continued to the present time. His large experience and practical knowledge, gained in building the water-works of many towns and cities, gave assurance of a thorough understanding of the work he would be called upon to perform. Pecuniarily responsible for the fulfilment of any contract he might make, energetic and skilful in the prosecution of the work entrusted to him, his interest in the success of the undertaking at all times prominent, we feel that no mistake has been made in com mitting to his hands so large a portion of the work performed. In the settlement of his demands against the city, we have satisfactorily adjusted all claims presented.

EDWIN WALDEN,
JACOB M. LEWIS,
JAMES PURINTON,
WILLIAM D. POOL,
DAVID H. SWEETSER.

# REPORT OF THE SUPERINTENDENT.

*To the Public Water Board:*

I herewith submit the Annual Report of the Superintendent of the City Water Works for the year 1872.

The general condition of the works is good. During the winter and early spring there were some troublesome leaks in the pipes, mostly confined to the 16-inch main in Summer Street, caused by the soft and yielding nature of the ground, allowing the pipes to settle and open the joints. They have all been repaired, at the expense of the contractor. We have had no leaks in that locality for several months. I think the pipes have become firmly imbedded, and will not cause much trouble in the future.

In the early part of the season the 20-inch force main was laid from the reservoir on Pine Hill to the new engine-house on Walnut Street, also the 16-inch distributing main from the reservoir to Walnut Street, and connected with the 16-inch main laid in 1871. Late in the year a new 18-inch pipe was laid from Breed's Pond to the well-chamber of the new engine-house, for the purpose of supplying the new pumping engine, now nearly ready to commence pumping into the reservoir; also, all the connections necessary for the new pumping and reservoir service were made.

There have been laid, during the year past, forty-three thousand seven hundred and ninety-four feet of street mains, a list of which is annexed in Table 1; also, fifty-eight gates have been set, as shown in Table 2; and sixty-eight new hydrants, the location of which is shown in Table 3. We have put in, during the year, seven hundred and twenty-four service pipes, amounting to thirty thousand seven hundred and sixty-nine feet, including extra pipe, and have also laid three thousand and seventy-eight feet of service pipe in various courts, as mains.

The pond, owing to the abundant rains, has continued to afford a full supply, with a large quantity running to waste most of the time. Early in July a gauge was placed in the pond, to show the depth of water above the sill of the gate-house, and a rain-gauge was placed at the pump-house. Both were placed under the care of the Engineer, who has carefully noted them. The record of his observations will be found in Tables 4 and 5.

The pump has continued to work fourteen hours per day, on regular working days, and five hours on Sundays; but, owing to its small capacity, we have been unable to furnish a constant and full supply to the highest parts of the city,—a deficiency which will now soon be remedied, as the new pumping engine is nearly completed. From careful estimates, we are now supplying to the city about seven hundred thousand gallons per day. We have used in the pumping service, the year past, nine hundred and eighty thousand six hundred and forty pounds of coal.

Four hydrants have been broken during the year, by teams. In all cases where the parties causing the damage could be ascertained, the cost has been charged to them. In several instances the pipes have been damaged by picks in excavating for drains and sewers, causing much trouble in shutting off the mains. In all cases the cost of repairs has been charged to those causing the damage. More care on the part of those putting in drains and sewers would save this unnecessary labor and expense.

Annexed is a schedule of all the stock and tools remaining on hand.

Respectfully submitted.

DANIEL WALDEN,
*Superintendent.*

# TABLE I.

## SHOWING THE AMOUNT OF PIPE LAID IN 1872.

| NAMES OF STREETS. | | | SIZE OF PIPE. | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Street.* | *From* | *To* | 20 | 18 | 16 | 8 | 6 | 4 |
| | Well Chamb'r | Reservoir . . | 1676 | | | | | |
| | Well Chamb'r | Reservoir . . | 187 | | | | | |
| | Reservoir . . | Walnut . . . | | | 1984 | | | |
| | Reservoir . . | Walnut . . . | | | 24 | | | |
| Chestnut . . | Adams . . . | Collins . . . | | | | | 753 | |
| Collins . . . . | Chestnut . . | Chatham . . | | | | | 1053 | |
| East Collins . | Chatham . . | | | | | | 488 | |
| Jackson . . . | Essex. . . . | | | | | | 1321 | |
| Empire . . . | Essex. . . . | | | | | | | 397 |
| Timson . . . | Chatham . . | | | | | | 1278½ | |
| Sumner . . . | Chatham . . | Fayette . . . | | | | | | 773 |
| Fayette . . . | Essex. . . | Collins . . . | | | | | 992 | |
| Fayette . . . | Bridge . . . | Essex. . . . | | | | | 994 | |
| Chippewa Ct. | Lewis. . . . | | | | | | | 561½ |
| Ingalls. . . . | Chatham . . | Jackson. . . | | | | | 991 | |
| Alice. . . . . | Essex. . . . | Ingalls . . . | | | | | | 653 |
| Fayette Court. | Fayette . . . | | | | | | | 292 |
| Highland Ave. | Essex. . . . | | | | | | | 303 |
| Essex Court . | | | | | | | 31 | 84 |
| Hutchins's Ct. | Essex Court. | | | | | | | 230 |
| James . . . . | Essex. . . . | Stewart . . . | | | | | | 400 |
| High Rock . . | Essex. . . . | Rockaway. . | | | | | 2414 | |
| Hollinsworth. | Rockaway. . | Herbert . . . | | | | | 902 | |
| Herbert . . . | Hollinsworth | High Rock . | | | | | 306 | |
| Henry Avenue | Johnson. . . | | | | | | 1387½ | 543 |
| Albany . . . | Arlington . . | Franklin . . | | | | | | 400 |
| Congress. . . | Main . . . . | Boston . . . | | | | | | 637 |
| Sagamore . . | Beach. . . | Newhall. . . | | | | | | 779 |
| Sea . . . . . | Broad. . . . | Pleasant. . . | | | | | 767½ | |
| South Church. | Summer. . . | | | | | | | 461½ |
| Bedford . . . | Shepard. . . | Blossom. . . | | | | | | 522 |
| Shepard . . . | Railroad . . | Alley . . . . | | | | | 230 | |
| Alley . . . . | Shepard. . . | | | | | | | 422 |
| George. . . . | Summer. . . | Warren . . . | | | | | | 400 |
| Warren . . . | George . . . | Commercial . | | | | | | 332½ |
| Curve . . . . | Neptune . . | | | | | | | 462 |
| Walden . . . | Summer. . . | Main . . . . | | | | | | 590 |
| Summer . . . | Main . . . . | Bridge . . . | | | | | 1161 | |
| River . . . . | Summer. . . | | | | | | 890 | |
| Nelson. . . . | Main . . . . | | | | | | | 659 |
| Allen . . . . | Main . . . . | | | | | | | 318½ |
| Ashland . . . | Boston . . . | | | | | | 939 | |
| Holyoke . . . | Myrtle . . . | Gardner. . . | | | | | | 339 |
| Oak & Walnut | Breed's Pond | Engine House | | 2228 | | | | |
| Forest Hill Av. | No. Franklin. | | | | | | 569 | |

| NAMES OF STREETS. | | | SIZE OF PIPE. | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Street.* | *From* | *To* | 20 | 18 | 16 | 8 | 6 | 4 |
| Maple . . . | Chestnut. . | Chatham . . | | | | 23 | 1781 | |
| Lake . . . | Maple . . . | Chestnut . . | | | | | 1933 | |
| Chestnut . | Maple . . . | Lake . . . . | | | | | 598 | |
| Chatham . | Maple . . . | | | | | | 1293 | |
| Gages Court | Lake. . . . | | | | | | | 412 |
| Mt. Pleasant | Essex . . . | Ridgeway. . | | | | | | 938 |
| Ridgeway . | Rockland . | | | | | | | 350 |
| Rockland . | Ridgeway . | Mt. Pleasant. | | | | | | 346 |
| Adams . . | Rockaway . | | | | | | 434 | |
| Friend . . | Silsbee. . . | Green. . . . | | | | | | 883 |
| | | Hydrant Pipe | | | | | 236 | 103 |
| | | | 1863 | 2228 | 2008 | 23 | 23,742½ | 13,591 |

## AMOUNT OF PIPE LAID IN COURTS IN 1872.

| *Name of Court.* | *Size.* | *Length.* |
|---|---|---|
| Suffolk Court . . . . . . . . . . . . . . . . . . . . | 1½ | 188 9 |
| Lovett Place. . . . . . . . . . . . . . . . . . . . | 1½ | 322 |
| Shepard Court. . . . . . . . . . . . . . . . . . . . | 1 | 194 |
| Barker's Court. . . . . . . . . . . . . . . . . . . . | 1½ | 198 3 |
| Elm Street Court . . . . . . . . . . . . . . . . . . | 1½ | 359 6 |
| Chapman Place . . . . . . . . . . . . . . . . . . . | 1¼ | 172 6 |
| Page's Court . . . . . . . . . . . . . . . . . . . . | 1¼ | 121 6 |
| Burchstead Court extension . . . . . . . . . . . . | 1½ | 193 3 |
| Hanover Street extension . . . . . . . . . . . . . | 1½ | 218 7 |
| Broad Street Court. . . . . . . . . . . . . . . . . | 1¼ | 199 9 |
| Healey's Arcade . . . . . . . . . . . . . . . . . . | 1½ | 110 3 |
| Hutchinson's Court extension. . . . . . . . . . . . | 1½ | 351 6 |
| South Street Court extension . . . . . . . . . . . | 1¼ | 176 |
| Edwards Court . . . . . . . . . . . . . . . . . . . | 1¼ | 183 |
| Holyoke Street extension. . . . . . . . . . . . . . | 1¼ | 99 6 |
| | | 3078 4 |

## TOTAL AMOUNT OF PIPE LAID IN THE CITY TO JAN. 1, 1873.

| | |
|---|---|
| 20-inch pipe laid in 1872 . . . . . . . . . . . . . . . . . . . | 1863 |
| 18-inch pipe laid in 1872 . . . . . . . . . . . . . . . . . . . | 2228 |
| 16-inch pipe laid in 1872 . . . . . . . . . . . . . . . . . . . | 2008 |
| 8-inch pipe laid in 1872 . . . . . . . . . . . . . . . . . . . | 23 |
| 6-inch pipe laid in 1872 . . . . . . . . . . . . . . . . . . . | 23,742 6 |
| 4-inch pipe laid in 1872 . . . . . . . . . . . . . . . . . . . | 13,591 |
| Pipes laid in courts in 1872 . . . . . . . . . . . . . . . | 3078 4 |
| Pipe laid for hydrants in 1872 . . . . . . . . . . . . . . | 339 |
| | 46,872 10 |

Total amount of pipe laid in 1872, 46,872 feet 10 inches, equal to 8 miles, 4,632 feet and 10 inches. Previously laid, 33 miles and 72 feet. Total amount of pipe laid, 41 miles, 4704 feet and 10 inches.

# TABLE II.

## SHOWING THE NUMBER AND SIZE OF GATES SET IN 1872.

| STREETS. | NO. | SIZE. | STREETS. | NO. | SIZE. |
|---|---|---|---|---|---|
| Collins | 2 | 6 | Alley | 1 | 4 |
| East Collins | 1 | 6 | George | 1 | 4 |
| Jackson | 1 | 6 | Warren | 1 | 4 |
| Empire | 1 | 4 | Curve | 1 | 4 |
| Timson | 1 | 6 | Walden | 2 | 4 |
| Sumner | 2 | 4 | Summer | 1 | 6 |
| Fayette | 3 | 6 | River | 1 | 6 |
| Chippewa Court | 1 | 4 | Nelson | 1 | 4 |
| Ingalls | 2 | 6 | Allen | 1 | 4 |
| Alice | 2 | 4 | Ashland | 1 | 6 |
| Fayette Court | 1 | 4 | Holyoke | 1 | 4 |
| Highland Avenue | 1 | 4 | Forest Hill Avenue | 1 | 6 |
| James | 2 | 4 | Lake | 2 | 6 |
| High Rock | 2 | 6 | Chestnut | 1 | 6 |
| Hollinsworth | 1 | 6 | Chatham | 1 | 6 |
| Herbert | 1 | 6 | Gage's Court | 1 | 4 |
| Henry Avenue | 2 | 4 | Mt. Pleasant | 1 | 4 |
| Henry Avenue | 1 | 6 | Adams | 1 | 6 |
| Albany | 2 | 4 |  |  |  |
| Congress | 2 | 4 |  | 58 |  |
| Sagamore | 2 | 4 | Previously set | 225 |  |
| Sea | 2 | 6 |  |  |  |
| South Church | 1 | 4 | Total | 283 |  |
| Bedford | 2 | 4 |  |  |  |

# TABLE III.

## SHOWING THE NUMBER AND LOCATION OF HYDRANTS SET IN 1872.

---

1. On Forest Hill Avenue, opposite Hancock Street.
2. Corner Holton and Laighton Streets.
3. At bend of Holton Street.
4. Corner Holton Street and Henry Avenue.
5. Corner Hollinsworth Street and Bay View Avenue.
6. Corner Hollinsworth and Herbert Streets.
7. Corner High Rock Street and High Rock Avenue.
8. Corner High Rock and Herbert Streets.
9. On High Rock, opposite Rock Street.
10. Corner High Rock and Acorn Streets.
11. On High Rock Street, opposite P. W. Butler's house.
12. On Maple Street, opposite No. 74.
13. At No. 95 Maple Street, near Cross Street.
14. Corner Maple and Lake Streets.
15. On Maple Street, opposite Chatham.
16. Corner Chatham Street and Western Avenue.
17. Corner Chatham and Lexington Streets.
18. Corner Chatham Street and Chatham Court.
19. End of Gage's Court.
20. On Lake Street, near Gage's Court.
21. At No. 24 Lake Street.
22. At bend of Lake Street. opposite Bowler.
23. At No. 54 Lake Street.
24. Corner Lake and Chestnut Streets.
25. Corner Chestnut and Bowler Streets.
26. On Ingalls Street, opposite Ingalls Court.
27. Corner Ingalls and Alice Streets.
28. At No. 30 Collins Street.
29. Corner Collins and Fayette Streets.
30. End of Collins Street.
31. On Fayette Street, opposite Franklin Place.
32. Middle of Sagamore Street.
33. End of Highland Avenue.
34. At No. 10 Hutchinson's Court.
35. End of Fayette Court.
36. Middle of Alice Street.
37. End of Jackson Street.
38. Corner of Jackson and Ingalls Streets.

39. At No. 14 Jackson Street.
40. On Fayette Street, opposite Sumner.
41. Middle of Ashland Street.
42. On Ashland Street, opposite John Raddin's house.
43. Junction of River and Canal Streets.
44. Middle of River Street.
45. On Summer Street, near Butman's mill.
46. Corner Summer and Linden Streets.
47. On Summer Street, opposite Alva.
48. Bend of Curve Street.
49. End of South Church Street.
50. Corner Timson and Empire Streets.
51. On Timson Street, near Chatham.
52. On Timson Street, opposite Smith's house.
53. End of Chippewa Court.
54. Middle of Congress Street.
55. Middle of Friend Street.
56. Middle of Empire Street.
57. End of Allen Street.
58. On Holyoke Street, opposite Gardner.
59. Middle of Sea Street.
60. Middle of Mt. Pleasant Street.
61. On Mt. Pleasant Street, opposite Rockland.
62. On Ridgeway Street, opposite Mt. Pleasant.
63. Corner Rockland and Ridgeway Streets.
64. West end of Alley Street.
65. On Chestnut Street, opposite Adams.
66. Corner Adams Street and Highland Avenue.
67. Middle of Nelson Street.
68. Corner Nelson and Hood Streets.

| | |
|---|---|
| Hydrants previously set | 259 |
| Hydrants set in 1872 | 68 |
| Total number of hydrants | 327 |

# TABLE IV.

SHOWING THE AMOUNT OF RAINFALL AT BREED'S POND, IN INCHES, FROM JULY 8 TO DECEMBER 31, 1872.

| DATE. | AMOUNT. | DATE. | AMOUNT. | DATE. | AMOUNT. |
|---|---|---|---|---|---|
| July 8 | 1.1 | Aug. 22 | 1.6 | Nov. 1 | .49 |
| 10 | .126 | 30 | 3.358 | 3 | .162 |
| 12 | .09 | Sept. 2 | .009 | 7 | 1.97 |
| 15 | .09 | 11 | .134 | 11 | .1 |
| 16 | .61 | 13 | .35 | 12 | .172 |
| 18 | .082 | 17 | 1.9 | 14 | .174 |
| 22 | .687 | 18 | .2 | 22 | .332 |
| 24 | .27 | 19 | .894 | 26 | .042 |
| 26 | .3 | 23 | .03 | 29 | .18 |
| 29 | .388 | 26 | .08 | Dec. 1 | .183 |
| 31 | .04 | 27 | 1.035 | 5 | .081 |
| Aug. 3 | .3 | Oct. 3 | .2 | 9 | .126 |
| 11 | .04 | 8 | 1.33 | 16 | .32 |
| 12 | .19 | 10 | .034 | 18 | .21 |
| 13 | 1.228 | 13 | .988 | 20 | 1.104 |
| 14 | 1. | 18 | .14 | 21 | .144 |
| 16 | 1.38 | 23 | .034 | 23 | .06 |
| 17 | .484 | 26 | .668 | 26 | .6 |
| 19 | .001 | 27 | .116 | 31 | .194 |

| | |
|---|---|
| Rainfall for the month of July | 3.783 |
| Rainfall for the month of August | 9 581 |
| Rainfall for the month of September | 4.632 |
| Rainfall for the month of October | 3.510 |
| Rainfall for the month of November | 3.622 |
| Rainfall for the month of December | 3.022 |
| Total rainfall to Jan. 1, 1872 | 28.150 |

# TABLE V.

SHOWING HEIGHT OF WATER AT BREED'S POND, ABOVE SILL OF GATE-HOUSE, EACH SATURDAY SINCE JULY 8, 1872. TOP OF WASTE WEIR 17 FEET 8½ INCHES ABOVE SILL OF GATE-HOUSE.

| DATE. | FT | IN | DATE. | FT. | IN. | DATE. | FT. | IN. | DATE. | FT. | IN. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| July 8 | 17 | 4¾ | Aug. 24 | 17 | 4¼ | Oct. 12 | 17 | 9½ | Nov. 30 | 17 | 9½ |
| 13 | 17 | 4⅛ | 31 | 17 | 11½ | 19 | 17 | 9¾ | Dec. 7 | 17 | 8¾ |
| 20 | 17 | 3¼ | Sept. 7 | 17 | 9 | 26 | 17 | 9 | 14 | 17 | 8½ |
| 27 | 17 | 2 | 14 | 17 | 8½ | Nov. 2 | 17 | 9¼ | 21 | 17 | 8⅛ |
| Aug. 3 | 16 | 11¾ | 21 | 17 | 10¼ | 9 | 17 | 11 | 28 | 17 | 8⅜ |
| 10 | 16 | 8¼ | 28 | 17 | 10¾ | 16 | 17 | 10 | | | |
| 17 | 16 | 10¼ | Oct. 5 | 17 | 9½ | 23 | 17 | 9¾ | | | |

# SCHEDULE OF STOCK AND TOOLS, JAN, 1, 1873.

| | |
|---|---|
| 21 | 1¼-inch to ¾-inch Ts. |
| 2 | 1¼-inch to ½-inch Ts. |
| 209 | 1-inch all round Ts. |
| 96 | 1-inch to ¾-inch Ts. |
| 134 | ¾-inch Ts. |
| 1 | 2-inch elbow. |
| 6 | 1½-inch elbows. |
| 11 | 1¼-inch elbows. |
| 32 | 1-inch elbows. |
| 57 | ¾-inch elbows. |
| 34 | 1-inch to ¾-inch elbows. |
| 14 | 1-inch unions. |
| 25 | 1-inch R. L. couplings. |
| 17 | ¾-inch R. L. couplings. |
| 14 | 2-inch couplings. |
| 77 | 1½-inch couplings. |
| 34 | 1¼-inch couplings. |
| 495 | 1-inch couplings. |
| 103 | ¾-inch couplings. |
| 33 | 1-inch to ¾-inch couplings. |
| 16 | 1½-inch caps. |
| 12 | 1¼-inch caps. |
| 75 | 1-inch caps. |
| 55 | ¾-inch caps. |
| 1 | 1¼-inch plug. |
| 58 | 1-inch plugs. |
| 121 | ¾-inch plugs. |
| 3 | 2-inch to ¾-inch cross. |
| 1 | 1-inch all round cross. |
| 382 | feet 2-inch pipe, not lined. |
| 35 | feet 1½-inch pipe, lined. |
| 40 | feet 1¼-inch pipe, lined. |
| 419 | feet 1-inch pipe, lined. |
| 170 | feet ¾-inch pipe, lined. |
| 245 | feet 1-inch pipe, not lined. |
| 392 | feet ¾-inch pipe, not lined. |
| 152 | feet 1½-inch pipe, imperfect. |
| 59 | feet 1-inch pipe. |
| 94 | feet 1-inch galv. pipe, lined. |
| 32 | feet 1-inch galvanized pipe, not lined. |
| 3 | 1½-inch stop and waste cocks. |
| 8 | 1¼-inch stop and waste cocks. |
| 93 | 1-inch stop and waste cocks. |
| 59 | ¾-inch stop and waste cocks. |
| 26 | hydrant waste cocks. |
| 25 | hydrant nipples. |
| 1 | 2-inch T, all round. |
| 1 | 2-inch to ¾-inch T. |
| 1 | 2-inch to 1-inch T. |
| 39 | 1½-inch to 1-inch Ts. |
| 20 | 1¼-inch to 1-inch Ts. |
| 22 | 1½-inch to ¾-inch Ts. |
| 1 | 2-inch to 1½-inch bushion. |
| 1 | 1½-inch to 1-inch bushion. |
| 1 | 1¼-inch to 1-inch bushion. |
| 14 | 1-inch to ¾-inch bushions. |
| 1 | ¾-inch to ½-inch bushion. |
| 12 | 1-inch nipples. |
| 7 | ¾-inch nipples. |
| 2 | 2-inch corporations. |
| 7 | 1-inch corporations. |
| 31 | ⅝-inch corporations. |
| 57 | ½-inch corporations. |
| 100 | lbs. plumbers' solder. |
| 10 | lbs. fine solder. |
| 30 | lbs. 2-inch pipe, lead. |
| 78 | lbs. 1¼-inch pipe, lead. |
| 205 | lbs. ⅝-inch pipe, lead. |
| 8 | 1-inch connections. |
| 12 | ¾-inch connections. |
| 64 | private hydrant covers. |
| 36 | private hydrant keys. |
| 8 | private hydrant pipes and cocks (cut.) |
| 4 | private hydrant rods. |
| 8 | private hydrant boxes. |
| 4 | service box covers. |
| 2 | bbls. cement. |
| 1 | ton hard coal. |
| 30 | bushels charcoal. |
| 100 | lbs. 10d nails. |
| 3 | gallons lard oil. |
| 2 | quarts kerosene oil. |
| 5 | lbs. sal amoniac. |
| 2 | lbs. resin. |

| | |
|---|---|
| 1 | lining machine, complete. |
| 30 | long handled shovels. |
| 24 | short handled shovels. |
| 30 | picks and handles. |
| 6 | iron bars. |
| 7 | tunneling bars. |
| 3 | striking hammers. |
| 2 | sledges. |
| 2 | spoons. |
| 2 | hoes. |
| 1 | rake. |
| 5 | drills. |
| 13 | pairs pipe tongs. |
| 2 | monkey wrenches. |
| 4 | pipe cutters. |
| 3 | die stocks. |
| 1 | 2-inch die. |
| 2 | 1½-inch dies. |
| 1 | 1¼-inch die. |
| 2 | 1-inch dies. |
| 1 | 1-inch die, long handled. |
| 1 | ¾-inch die. |
| 1 | ¾-inch die, long handled. |
| 1 | 1-inch tap. |
| 1 | ¾-inch tap. |
| 1 | tap wrench. |
| 2 | vises. |
| 6 | solder irons. |
| 1 | solder pot. |
| 1 | solder mould. |
| 1 | 2-in. pipe drill and stuffing box. |
| 2 | 1-in. pipe drills and stuffing box |
| 3 | ⅝-in. pipe drills and stuffing box |
| 2 | ¾-in. pipe drills and stuffing box |
| 1 | ½-in. pipe drill and stuffing box |
| 1 | brace. |
| 1 | wrench. |
| 2 | hydrant nipple wrenches. |
| 3 | stop wrenches. |
| 3 | gate keys. |
| 1 | spoon for boxes. |
| 2 | tape measures. |
| 1 | axe. |
| 9 | pails. |
| 6 | long rammers. |
| 3 | paving rammers. |
| 2 | rammer heads. |
| 1 | red lead brush. |
| 1 | pave hammer. |
| 2 | claw hammers. |
| 2 | trowels. |
| 1 | oil feeder. |
| 1 | broom. |
| 1 | stamp, L. P. W. B. |
| 2 | handsaws. |
| 50 | feet rubber hose and pipe. |
| 2 | corn brooms. |
| 1 | tin dipper. |
| 1 | kerosene lamp. |
| 8 | lanterns. |
| 2 | kerosene oil cans. |
| 1 | 5 gallon lard oil can. |
| 1 | lining bench. |
| 1 | cutting bench. |
| 1 | tank for testing metres. |
| 1 | sink. |
| 6 | pairs rubber mittens. |
| 1 | smoke cowl. |
| 2 | long fencing horses. |
| 2 | small fencing horses. |
| 1 | stove and pipe. |
| 15 | fathoms 2-inch rope. |
| 3 | kettles for thawing out pipes with hose. |
| 21 | lengths small pipe. |
| 4 | pairs rubber boots. |
| 1 | coal shed. |
| 1 | wheel-barrow. |
| 1 | hand-cart. |
| 1 | tool-box for ledgemen. |
| 2 | fire pots. |
| 1 | lantern globe. |
| 2 | horses. |
| 1 | heavy wagon and harness. |
| 1 | light wagon and harness. |
| 1 | pung. |

# REPORT OF THE CLERK.

*To the Public Water Board:*

I herewith submit the Annual Report of the Clerk of the Public Water Board for the year 1872.

The total number of services on the first day of January, 1873, was 2,194. The water has been turned on to 2,006, leaving 188 not yet turned on. The total number of water takers on the first of January was 2,805, viz: 1,756 dwellings, occupied by 2,485 families, 107 stables, 103 shoe factories, 11 morocco factories, 146 stores, 5 printing offices, 3 banks, 37 steam-engines, 4 planing mills, 3 hotels, 60 boarding-houses, 4 churches, 4 bakeries, 26 school-houses, 3 steam fire engine houses, 11 restaurants, 1 foundry, 2 market houses, 2 public halls, Post Office and City Hall. Total number of faucets, 3,907; 408 water closets, 152 bath tubs, 628 hand-hose.

One hundred and sixteen services have been shut off during the year for non-payment. Sixty-six have since paid, and the water turned on again. Owing to the time occupied in preparing the necessary books, and collecting information of the number of water-takers and the fixtures used by each, the water bills payable on the first of October, 1871, were not ready to present until the first of February, 1872; therefore the receipts herewith presented includes one year and a half, viz: from October 1, 1871, to April 1, 1873.

In addition to the regular collections of the office, most of the bills for extra pipe, put in by Mr. George H. Norman during the years 1870 and 1871, have been collected. The total receipts during the year have been as follows: —

| | | |
|---|---|---|
| For water rates, | $35,893 39 | |
| Building purposes, | 110 23 | |
| Watering streets, | 257 90 | |
| Fines for non-payment, | 132 00 | |
| Rents for buildings and land, | 163 64 | |
| | | $36,557 16 |
| Extra pipe, private hydrants, etc., | | 13,632 26 |
| Total amount received, | | $50,189 42 |

All of which has been paid into the city treasury.

# *EXPENDITURES FOR 1872.*

*Amount of Bills approved by Public Water Board from Jan.* 1, 1872, *to January* 1, 1873.

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### CONSTRUCTION ACCOUNT.

| | | |
|---|---|---|
| Engine-house and foundations, | | $35,545 72 |
| Pumping engine, including interest, | | 38,156 25 |
| Engineering, | | 1,680 00 |
| Street mains and service pipes, | $155,741 19 | |
| Deduct amount received for extra pipe, | 13,632 26 | |
| | | $142,108 93 |

### MAINTENANCE.

| | | |
|---|---|---|
| Salaries and office expenses, | $2,866 34 | |
| Pumping service, | 5,758 55 | |
| Repair and sundry expenses, | 1,542 29 | |
| Interest account, | 28,526 17 | |
| | $38,693 35 | |
| Deduct amount received for water, | 36,557 16 | |
| Balance carried to construction account, | | $2,136 19 |
| Total, | | $219,627 09 |

# TOTAL EXPENDITURES

*Made by the Committee on Introduction of Water and the Public Water Board, from Jan.* 1, 1869, *to Jan.* 1, 1873.

---

| | | |
|---|---|---|
| For Breed's Pond and buildings, | $21,500 00 | |
| Repairing dam, | 8,737 16 | |
| | | $30,237 16 |
| Steam pump, | | 7,800 00 |
| Reservoir, | | 60,700 00 |
| Engine house and land, | | 47,459 00 |
| Pumping engine and boilers, | | 38,156 25 |
| Engineering, including preliminary survey, | | 8,464 99 |
| Street mains, hydrants and gates, 1869, | $32,033 57 | |
| Street mains, hydrants and gates, 1870, | 29,155 75 | |
| Street mains, hydrants and gates, 1871, | 284,749 05 | |
| Street mains and services, 1872, | 142,108 93 | |
| | | $488.047 30 |
| Maintenance, 1870, | $1,071 41 | |
| Maintenance, 1871, | 5,461 78 | |
| Maintenance, 1872,* | 2,136 19 | |
| | | $8,669 38 |
| | | $689,534 08 |

Respectfully submitted.

DANIEL WALDEN, *Clerk.*

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* The excess of maintenance and interest over income.

# REPORT OF THE ENGINEER.

*President Public Water Board:*

*Sir:* — At your request I have made a survey of Hawkes' Brook, Penny Brook and Birch, or Beaver, Brook, for the purpose of supplying the city of Lynn with additional water.

By reference to the accompanying plot it will be observed that that portion of the towns of Lynn, Saugus and Lynnfield (shaded on the map), — lying westerly of the city proper, and bounded on the north by a range of high hills which form the southern limit to the watershed of the Flax, Sluice and Cedar Ponds, varying in distance from three to twelve hundred feet south of the so-called Lynnfield Road, also bounded on the south by Walnut Street or the South Reading Road, for a distance of about four miles due westerly, making an area of six square miles, — all slopes southerly, forming four distinct streams, which drain this entire district.

No. 1, Breed's Pond, drains nearly one square mile.

No. 2, Beaver Brook, a like area.

No. 3 and 4, Penny and Hawkes' Brooks, four and one-quarter square miles.

No. 1, or Breed's Pond, at present supplies the city.

The water from No. 2, or Beaver Brook, can be readily conveyed into the pump-well of the new engine house, by constructing a dam about two hundred feet in length and fifteen feet in height, at a point near its crossing of Walnut Street, about one-half mile west of Breed's Pond, also a conduit to engine house, forming a reservoir of fifty-five acres, or one-fifth larger than Breed's Pond. The estimated expense attending the construction of this reservoir and conduit will be ninety thousand dollars.

The waters of No. 3 and 4 can be conveyed into No. 2, or Beaver Brook Reservoir (and thus to pump-well), by means of a conduit or pipe one and one-quarter mile in length. In consequence of an intervening hill on the line of this pipe, at or near the junction of Walnut Street and the Saugus Road, it will be necessary to make an excavation through rock, forty-one feet in depth at the deepest point, for a distance of one thousand feet.

Whenever No. 3 and 4 are added to the city supply, it would be advisable to build a storing reservoir at Hawkes' Brook, also at Penny Brook, although not strictly necessary for the purpose of conducting the water to the engine house, but would be a prudent measure as a means of obtaining ample storage capacity to pass through a drouth of several months' duration in future, especially as at each of the points mentioned excellent opportunities are offered for their construction.

The estimate of Penny Brook Reservoir, covering one hundred acres, including the heavy cut, is one hundred and forty thousand dollars, and Hawkes' Brook Reservoir, forty acres, is thirty-five thousand dollars, making a total cost of two hundred and sixty-five thousand dollars, with a water supply of six million gallons daily, and a storage capacity of over seven hundred million gallons, including Breed's Pond.

By this plan the expense attending an additional supply may be carried through a series of years, and constructed from time to time as your necessities may demand. The Beaver Brook Reservoir should be constructed the coming season, and the others at such time as may then be deemed advisable.

I have estimated the pipe leading from Beaver Brook to engine house, of thirty inch internal diameter, sufficient to convey six millions gallons daily. Should you deem advisable, a twenty inch main may be at first laid, which would decrease the present outlay thirty thousand dollars, in which case a twenty-four inch pipe can be laid whenever the Hawkes' or Penny Brook project is constructed. This would give the advantage of having two distinct mains, and not materially increase the total expense, taking into consideration interest account for a period of five years.

The watershed of this entire district is sparsely settled, of wild, rough and rocky nature, primitive formation, not liable to the contaminations due from either the cultivation of the soil or that of a thickly settled district, and will doubtless remain in its present unsettled condition for very many years.

Respectfully submitted.

GEO. H. BISHOP, *Engineer.*

# WATER ACT.

## AN ACT TO SUPPLY THE CITY OF LYNN WITH PURE WATER.

*Be it enacted, etc., as follows:*

SECTION 1. The city of Lynn is hereby authorized to supply itself and its inhabitants with pure water for domestic and other purposes; and for this purpose is authorized to take, hold and convey into and through said city the waters of Breed's Pond, so called, in said city, and the waters which flow into and from the same, and any water rights connected therewith, and the streams running into Beaver Brook, below Breed's Pond, and the brook rising in Pine Hill Pasture, and running by Holmes' Mill; and may take and hold, by purchase or otherwise, such land on and around the margin of said pond, not exceeding five rods in width, as may be necessary for the preservation and purity of said waters; and may also take and hold in like manner such land as may be necessary for erecting and maintaining dams and reservoirs, and for laying and maintaining conduits, pipes, drains and other works for collecting, raising, conducting and distributing said waters through said city. And the action of said city in the purchase of said Breed's Pond, and laying pipes therefrom, is hereby ratified.

SECT. 2. The Mayor of said city of Lynn shall, within sixty days after taking any of the land aforesaid, file in the Registry of Deeds for the County of Essex, Southern District, a description thereof sufficiently accurate for identification.

SECT. 3. Said city, for the purposes aforesaid, may build aqueducts from said Breed's Pond, and maintain the same by any works suitable therefor; may provide and maintain suitable machinery for raising the water above the source of supply; may erect such structures as are necessary for preserving the works; may make and maintain suitable dams and reservoirs, and establish such public fountains and hydrants as are at any time deemed proper, and may change or discontinue the same; may distribute the water throughout said city, regulate its use, and establish the rates to be paid therefor. Said city may also, for the purposes aforesaid, carry its pipes and other works over or under any water-course, street, railroad or highway, in such manner as not to obstruct the same; and may do any other acts and things necessary and proper in executing the purposes of this act.

SECT. 4. Said city shall be liable to pay all damages sustained by any person or corporation by taking any land, water, water rights, or property, or by the constructing of any aqueduct, reservoir, or other works for the purposes aforesaid; and if any person or corporation, sustaining damages as aforesaid, cannot agree with the city upon the amount of such damages, he or it may have them assessed in the same manner as is provided by law with respect to land taken for highways.

SECT. 5. For the purposes of defraying the cost and expenses which may be incurred under the provisions of this act, said city shall have authority to issue bonds to be denominated City of Lynn Water Loan, to an amount not exceeding in the whole three hundred thousand dollars, payable at periods not exceeding twenty years from the date thereof, with interest payable semi-annually, at a rate not exceeding seven per centum per annum. And said city may sell said bonds at public or private sale upon such terms and conditions as it may deem proper. The net surplus income and receipts shall be set apart as a sinking fund, and applied solely to the payment of the principal of said loan. The Mayor, City Treasurer and President of the Common Council for the time being, shall be trustees of said fund, and shall, whenever required by the City Council, render an account of all their doings in relation thereto.

SECT. 6. The rights, powers and privileges hereby granted, may be exercised by such officers, agents and servants as such city may select or employ, who shall be subject to such ordinances, rules and regulations as the City Council may establish, and the Mayor shall be eligible to such office.

SECT. 7. If any person shall use any of the said water without the consent of said city, or shall wantonly or maliciously divert the water, or any part thereof, of any of the ponds, springs, streams or sources of water taken or held by said city, pursuant to the provisions of this act, or corrupt the same, or render it impure, or destroy or injure any dam, aqueduct, pipe, conduit, hydrant, machinery or other works or property held, owned or used by said city, under the authority and for the purposes of this act, he shall forfeit and pay to said city three times the amount of damages assessed therefor, to be recovered in an action of tort, and on conviction of either of the wanton or malicious acts aforesaid, may also be punished by fine not exceeding three hundred dollars, or by imprisonment in jail not exceeding one year.

SECT. 8. This act shall take effect upon its passage.

# WATER ORDINANCE.

SECTION 1. As soon as may be, after the passage of this Ordinance, there shall be chosen by the City Council, by joint ballot, in convention of both branches thereof, five persons, residents of the city, to be members of the Public Water Board, with the powers and duties hereinafter set forth. And said persons shall hold their office as follows, viz: One for the term of four years, one for three years, one for two years, one for one year, severally from the month of January next ensuing, and one for such term as may elapse until said month of January. And within said month, and as soon as may be after the organization of the city government, and thereafter annually, at the same time, there shall be chosen, in manner as above, one member of said board, to hold his office for the term of five years. Any vacancy arising in said number shall be filled by the City Council for the unexpired term, in the manner above prescribed.

SECT. 2. The persons so chosen shall constitute the Public Water Board of the City of Lynn. They shall, immediately after their first election, or after the choice of members, annually, meet and organize by the choice of a President, who shall be of their own number, and a Clerk, who shall not be a member of the board; after which they may proceed to appoint a Superintendent of Water Works, or such other officer or officers in place thereof as they may deem proper and necessary. They may prescribe the duties of such officers appointed by them, fix their terms of office, removing and replacing them at their discretion, and may establish their compensation and also that of the Clerk, at any sum which the City Council may approve.

SECT. 3 The Board, thus constituted, shall have the exclusive and entire charge, superintendence and oversight of all structures, works, arrangements and apparatus designed and provided for the obtaining and supplying of pure water for the uses of the city. They shall receive from the City Council, or any committee thereof previously acting, any and all such works and arrangements as may have been already established, and any such party, so delivering the charge thereof, shall thereafter be free of all responsibility for the management of the same. And after the due constitution and organization of the Board as aforesaid, the City Council shall not place in the hands of any committee or commission, for execution, any orders for the construction, management or repair of any such works, structures or arrangements, whether newly determined on or otherwise; but all such matters, and the execution and consummation thereof, shall be entrusted to the Board as above provided.

SECT. 4. Said Board shall have control and jurisdiction over all lakes, ponds, streams and bodies of water provided or possessed by the city for supply as aforesaid, and of all lands adjacent or appurtenant thereto, and owned or lawfully controlled by the city. And they may exercise all rights as to entry upon and passage over private premises which now are or hereafter may become vested in the city government, as belonging or relating to the management and supply of water as aforesaid.

SECT. 5. Said Board, and every member thereof, shall use diligent care for the protection and security of all sources of water from which a supply is in any part obtained, so that the purity and salubrity thereof may not be impaired. And for this purpose they shall, individually, have, enjoy and exercise all the powers of police officers in relation to trespassers upon the sources of water in their charge, or upon the lands or works connected therewith, and may arrest or complain of such offenders, that they may be dealt with according to law. And upon application made by said Board, the Mayor and Aldermen may, in their discretion, extend the powers above stated to the Clerk, Superintendent, or other officer of the Board, to be by him exercised in like manner.

SECT. 6. Said Board shall, once in each calendar month, meet and examine all bills and claims by them incurred in the prosecution of their duty; and all claims approved shall be certified by their President, and passed to the Auditor of Accounts for allowance and payment. And a full statement of all contracts, obligations and pecuniary arrangements entered into by the Board, shall be seasonably deposited with the Auditor, as required by the ordinance of the city. The Board shall also, on or before the first Monday of March, June, September and December, in each year, report to the City Council such statement of their proceedings as may be required, and also any supplementary report at intermediate times as shall be demanded; and they shall furthermore, on or before the last day of December, make to the City Council a full report in detail of all their official acts and doings for the year preceding.

SECT. 7. The Board shall, in consultation with the Board of Engineers of the Fire Department, make all proper and necessary arrangements for the sufficient supply of water for use at fires, and for the affording of the same in the most efficient and suitable manner. Also, in consultation with the Mayor and Aldermen, or any committee thereof, or of the City Council, they shall arrange for such supply of water as may be required for the operating of any public fountain or ornamental public water works, or for the flushing and cleansing of any public sewer or drain, or for any other use clearly distinct from that of ordinary water-takers: *Provided, however*, that the arrangements last described shall in no case be made or continued when the supply of water to ordinary takers shall be liable so to be diminished or impaired.

SECT. 8. The Board shall have exclusive charge of the supply of water to all private takers of the same, and may make all necessary arrangements therefor, establishing all such regulations as may be judicious, and fixing and ordaining all schedules and tariffs of water-rates that may be proper. And all such regulations and water-rates, with all alterations thereof, shall be reported to the City Council for approval; and, when so approved, they shall have all the force of ordinances of the city, and may be enforced in like manner.

SECT. 9. All rents and rates for the use of water shall be payable at such times, and collected in such manner, as said Board may determine: *provided*, that all bills for the use of water, remaining due and unpaid for the space of thirty days after presentation, shall be deposited with the City Treasurer, to be by him collected according to law. All sums received by the Board for the use of water, or for the sale of any other matter or thing lawfully held by them, shall be paid weekly into the City Treasury, and a receipt taken for the same.

SECT. 10. If at any time it shall appear to the Board advisable that the supply of water should be extended and afforded to takers not belonging to the city and residing beyond its limits, they shall make a special report to the City Council, stating the facts in the case, and the City Council may, if they deem fit, pass an order thereon, permitting such use of the water as aforesaid, during such period as said order shall define; and the Water Board may then supply the water according to the terms of the order: *Provided, however*, that the rate charged to such parties shall not be more favorable than to the residents of the city; nor shall such supply be continued when it may tend to diminish the quantity to which such residents are entitled.

SECT. 11. No member of the Board, and no person officially acting under their appointment, shall be a party to any contract, bargain or sale of property or material connected with the water supply, wherein either the Board, the City Council, or any committee thereof shall be the other party; but all such contracts, bargains or agreements, made in violation hereof, shall be utterly void as to the city. The members of the Board shall receive no compensation for their services, and neither they, nor any officer appointed under their authority, shall demand or receive any fee or reward for service to any person in connection with his duty.

SECT. 12. All the acts and doings of the Public Water Board, and of the several members thereof, shall always be open to review and correction by the City Council; and in case of any malfeasance, or failure or neglect of duty by them, or either of them, the City Council, upon complaint made to them, may give notice and hearing to the party accused, and thereafter, if they see cause, remove from office said Board, or the offending portion thereof, and thereupon proceed to a new election to fill the vacancies so occasioned.

# WATER RATES.

The following rates shall be charged annually for the use of water: —

## DWELLING-HOUSES.

| | |
|---|---|
| Dwelling-Houses occupied by one family, for first faucet, | $6 00 |
| For each additional faucet, to be used by same family, | 2 00 |
| When a house is occupied by more than one family, and less than four, one faucet only being used by all, for each family, | 4 00 |
| When a house is occupied by four or more families, and but one faucet is used by all, for each family, | 3 50 |
| When a house is occupied by more than one family, the highest rates will be charged for each family having the water carried into their part of the house. | |
| For the first bath-tub, | 5 00 |
| For each additional bath-tub, | 3 00 |
| For the first water-closet, | 5 00 |
| For each additional water-closet, | 3 00 |
| For hopper water-closets special rates will be made. | |
| Where bath-tubs or water-closets are used by more than one family, for each family, | 4 00 |
| Where two faucets are used, one for hot and one for cold water, and both emptying into one basin, but one charge will be made for both. | |
| Provided that in no case shall the charge for the use of water by a private family, exclusive of hose and stable, be more than | 25 00 |

## BOARDING-HOUSES.

| | |
|---|---|
| For the first faucet, | $10 00 |
| Each additional faucet, | 3 00 |
| Water-closet or bath-tub, when used by boarders, each | 10 00 |
| Each additional bath-tub or water-closet, | 3 00 |

## STORES, OFFICES, WAREHOUSES, ETC., NOT INCLUDING MANUFACTORIES OR WORKSHOPS.

| | |
|---|---|
| First faucet, | $5 00 |

| | |
|---|---|
| Where two or more tenants are supplied from the same faucet, each, | $4 00 |
| Water-closet used by occupants of one tenement only, | 5 00 |
| When used by occupants of more than one tenement, for each tenant, | 4 00 |

For each additional faucet or water-closet, half of above rates will be charged.

## MARKETS, SALOONS, RESTAURANTS, WORKSHOPS.

| | |
|---|---|
| For markets, saloons, restaurants, workshops, or for purposes not included in any other classification, and not requiring more than an ordinary supply of water, from | $6 to $25 |

## HOTELS.

| | |
|---|---|
| For each bed for boarders and lodgers, | $3 50 |

## PUBLIC BATHS.

| | |
|---|---|
| For each tub in a public bath-house or hotel, | $8 00 |
| For each water-closet in a public bath-house, | 8 00 |

## STABLES.

| | |
|---|---|
| Private Stable. — For the first horse, | $5 00 |
| For each additional horse, | 3 00 |
| For each cow, | 1 50 |
| Livery, Club and Boarding Stables. — For each horse, | 3 00 |
| Car and Omnibus Stables. — For each horse, | 2 00 |
| Truck and Cart Stables. — For each horse, | 2 00 |
| Provided that in no case shall any stable be charged less than | 5 00 |

The rates for stables include water for washing carriages without hose.

## HOSE.

| | |
|---|---|
| For hose of not over three-eighths inch orifice, used for washing windows, sprinkling streets or watering gardens (and the use of the same shall be limited to one hour per day) not less than | $3 00 |

## STEAM ENGINES.

| | |
|---|---|
| For each engine working not over twelve hours a day, for each horse power, | 6 00 |

## BUILDING PURPOSES.

| | |
|---|---|
| For each cask of lime or cement used, | 6 cents. |

### MANUFACTURING AND OTHER PURPOSES.

In all cases where large quantities of water are required, the charge for the same shall be as follows, the quantity to be ascertained by metres: —

For the first 2000 gallons daily used, at the rate of 4 cents for 100 gallons.

For the quantity in excess of 2000 gallons, and up to 5000 gallons, at the rate of 3 cents for 100 gallons.

For the quantity in excess of 5000 gallons, and up to 12,000 gallons, at the rate of 2 cents for 100 gallons.

In excess of 12,000 gallons the price of the excess shall be fixed by the Board.

The Water Board shall have the power to ascertain by metre the quantity used in every case, and the rates shall be charged as set forth under the head of manufacturing and other purposes.

When water is used for purposes not specified in the foregoing tariff, the rate shall be fixed by the Water Board.

## REGULATIONS.

The following regulations shall be considered a part of the contract with every person who uses the water: —

All applications for the use of water must be made at the office, and the various uses to which the water is to be applied must be stated fully and truly; and should use for any other purpose be required, notice must be given before it will be allowed.

Persons taking water must keep their water-pipes and fixtures in good repair and protected from frost at their own expense, and will be held liable for any damage resulting from their failure to do so.

They shall prevent any unnecessary waste, and the water must not be left running to prevent freezing.

There shall be no concealment of the purposes for which it is used.

No alterations shall be made in any of the pipes or fixtures inserted by the city, except by its agents, who shall have free access to the premises supplied, to examine the apparatus and to ascertain the quantity of water used, the manner of its use, and whether there is any unnecessary waste.

No water will be supplied to parties not entitled to its use under the city ordinances, unless by special permission.

Service pipes will be laid to the line of the street and through the cellar wall, *provided the same is not more than twelve feet from the line of the street*, without charge; and all applicants for whom the pipe is laid will be charged for the use of one faucet whether the water is used or not.

The regular rent for the use of water shall be payable in advance, on the first days of October and April in each year. In all cases of non-payment of the water rent in thirty days after the same is due, or of violation of the foregoing rules, the supply shall be cut off, and the water shall not again be let on except upon the payment of the rent due and the sum of two dollars.

# APPENDIX.

The following table, which is compiled from the record kept at the Pumping Station, exhibits the performance of the engine during several tests: —

| Number of the trial | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Date of the trial | March 12, 13. | March 17 to 20 | March 25, 26. | March 31 to April 2. |
| Duration of the trial hours | 34 h. | 77 h. 30 m. | 30 h. 25 m. | 48 h. |
| Revolutions made by the engine | 33,024 | 76,273 | 36,074 | 40,587 |
| Number of gallons pumped on the trial | 6,436.708 | 14,866,370 | 7,031,183 | 7,940,845 |
| Head in feet against pump | 147 41 | 147.48 | 153.19 | 149.47 |
| Coal consumed during the trial, in pounds | 9,100 | 20,300 | 9,650 | 10,396 |
| Duty of the engine in lbs. raised 1 ft. by 100 lbs. coal | 87,000,000 | 90,400,000 | 93,116,700 | 94,494,000 |

In all the trials the fires were left equally good at the end as at the commencement, and no deductions were made for ashes or clinkers in the coal.

Trial No. 1 was made with both boilers in use and Lackawanna coal. Trial No. 2 was made with but one boiler and using Lackawanna coal. Trials No. 3 and 4 were made with one boiler, using Cumberland coal, and during very unfavorable weather.

From March 15 to April 3, both inclusive, the engine made in 232½ hours running time 225,348 revolutions, and pumped 43,922,520 gallons, against an average head of $149\frac{12}{100}$ feet, with a total consumption of 62,740 pounds of coal, which gives a duty of 87,065,360 pounds raised one foot by the consumption of one hundred pounds of coal.

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# ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD

OF THE

# CITY OF LYNN,

FOR THE YEAR ENDING DECEMBER 31, 1873.

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# REPORT OF THE PUBLIC WATER BOARD.

As required by the Sixth Section of the "Ordinance for the Regulation of the Water Supply of the City," the Public Water Board hereby present to the City Council their Second Annual Report; which report contains a "full statement of all their official acts and doings for the year" 1873.

Appended will be found the report of the Clerk of the Board and of the Superintendent of the works, and also the report of the Board of Experts who were appointed to determine the capacity of the pumping engine, erected during the year, and the economy with which its work is performed.

The report of the Clerk contains so full a statement of the supply of water to the city and the variety of purposes for which it is used, the increase in the number of water-takers and in the number and variety of fixtures employed, that no further statement is deemed necessary.

In the Clerk's report will also be found a general statement of the expenditures by the Board, on account of the extension and maintenance of the works for the year 1873, an itemized account of which will be found in the report of the City Auditor; also, a statement of the cost of the works from the date of the first outlay, in 1869, to the close of the year 1873. The amount of the receipts by the water department during the year, and the increase over the previous year, are also so fully given as to make any statement by the Board superfluous.

We invite your attention to the report of the Superintendent of the Works for information relating to the sources of supply, and the general condition of the water works of the city. Especially do we ask you to consider that portion of the report which refers to the quantity of water used by those employing hand-hose, and the cost of supplying the same. The waste which is constantly going on by reason of imperfect fixtures, and faucets carelessly left open, can easily be inferred from the statement showing the quantity of water an ordinary faucet will discharge, when supplied from the reservoir. The report also contains other valuable information relating to the pumping engine and other parts of the works, which, with the tables presented, will quite fully inform you of the work of the year, and the success which has attended the introduction of water into our city.

The Water Board for the year 1873 was without change in its membership, the City Council re-electing for a full term, Mr. David H. Sweetser, whose term of office expired in January. The organization of the Board, as also the appointments it is authorized to make, were also unchanged for the year. The positions of Clerk of the Board and Superintendent of the Works have been filled, as heretofore, by one appointee, who has been assisted in the discharge of his duties by an obliging and competent assistant.

Having the entire confidence of the Board the present Superintendent of the works will be retained for the coming year. The competency he brings to the varied duties of his place, the faithfulness of his supervision, his interest in the successful working of the department so largely entrusted to his care, as well as the economy which marks his management, entitle him to the confidence and respect of the community he so devotedly serves. The services required of this officer demand his full time and attention, and a salary adequately compensating him for the exacting and perplexing round of duties he is expected to perform should be allowed. If, therefore, the Board should increase his salary, and transfer to another the duties of the Clerk of the Board and Water Registrar, we trust our action will be regarded with favor by the City Council.

The First Annual Report of the Water Board furnished a brief description of the water works of the city, and a statement of their condition at the close of the year 1872. At the present time we shall refer to those portions of the works which were then in an unfinished condition, or for some cause had not fully satisfied the expectation of the Board.

### DISTRIBUTING RESERVOIR.

The Distributing Reservoir, mainly built in 1871, was regarded at the date of our last annual report as almost unserviceable. The loss of water appeared to be wholly by filtration through the bottom, as none of the tests resorted to to show the defect developed any leak through the embankments, nor was there any following of water discoverable along the lines of the force and supply mains which connect with the reservoir.

The Committee of the City Council for the year 1871, to whom was entrusted the construction of the reservoir, accepted the judgment of those who were experienced in building similar works, and whose knowledge, in regard to the kind of material required to render such a basin water-tight, could hardly be questioned. But the opinions of all who were consulted proved unreliable, and the experiment demonstrated that the natural bed of our reservoir, although containing a considerable portion of clay in its composition, would not, unless worked and mixed with other material, hold water under pressure. Satisfied that the contractor's work was faithfully performed, the Board decided to cover the bottom and that portion of the slopes made by the excavation, with a puddle of clay and gravel to a depth of two feet. Competent foremen were engaged, and the work was commenced early in May.

That the capacity of the reservoir should not be diminished, it became necessary to remove as much material from the bottom and slopes as would make room for the clay to be used in puddling. From two to three feet of excavation was made, and all the material not fit for use was carried away. The lower courses of the slope wall were disturbed, that the puddle might be properly connected with the puddle-wall in the embankments. Driveways were built into the reservoir at two points for the convenient carrying in and out of material.

As it was desirable that the supply of water to the city should be delivered from the reservoir — the head being sufficient to serve all sections of the city and render the fire hydrants effective — this advantage was secured by connecting the force and supply mains at the gate-house, and using the force main as a stand-pipe. The pumping-engine was kept running at its lowest speed, night and day, and the surplus of water lifted, above consumption, was disposed of through an overflow pipe which discharged it into the pond below. By this arrangement the water required for puddling was obtained, and conveniently carried to any part of the reservoir.

The material to be removed consisted, in part, of stone suitable for use in building a division wall across the reservoir. As this could be done at small cost and with much advantage in prosecuting the work, the area was divided into two nearly equal sections by a wall seven feet in height. Through the centre of this wall was placed a well-worked puddle four feet in thickness, making it water-tight. Two twenty-inch pipes were laid through it, to be connected with the force and supply mains at the gate-house whenever the separate use of either division of the reservoir shall become necessary to allow of repairs or alterations. This arrangement also permitted the use of the first section before completing the entire work, and when in use no more water was required to be pumped than the actual consumption demanded. The large area to be worked, and the exceedingly difficult excavation to be carried on, required a large force of men and teams and all who could be profitably employed were placed at work, and the first division was put in condition. Water was let in on the twenty-eighth day of July, and the subsidence carefully noted. At first the loss of water was apparently greater than could be accounted for by the processes of evaporation and absorption, but the waste gradually diminished, and after a few weeks this portion of the reservoir was declared to be tight. Continuous pumping was not now required in order to supply the city, and the extra expense for labor and coal, which the night work had made necessary, could be saved. The stand-pipe was abandoned, night work was discontinued, and the supply of water to the city was again furnished from the reservoir.

The work required to put the second division in condition was more rapidly performed; partly because a larger working force was employed, and partly because the excavation was more easily worked. The depth of the puddling was also slightly diminished. On the twenty-second of September, the entire work was completed, and the two divisions put in connection. For a while a considerable waste of water was observed near the road which skirts the pond, and an unusual flow was noticed in the small brook which crosses Walnut Street, near Oak Street. This little stream comes to the surface through two fissures in the ledge on the south-westerly side of the hill below the reservoir grounds, and about one hundred and fifty feet distant from Walnut Street. These openings are eight feet higher than Breed's Pond, and it is proposed to conduct the water which flows from them to the supply main from that pond.

The weather during the five months while this work was going on was remarkably dry. The hot sun and drying winds rapidly evaporated the moisture from the puddle and cracked the surface, making a second cutting over a considerable portion of the work necessary. Doubtless through some of these sun-cracks the waste observed has found its way. The loss of water is, however, constantly diminishing, and we are assured by competent engineers that the reservoir in a short time, will be wholly tight.

At the time of commencing this work, the top and exterior slopes of the reservoir were unfinished. To suitably grade and soil them was the work of the contractor. The rough and uneven character of the ground at the base of the slopes, required a uniform grade to be established before this work could be properly done. Besides, hundreds of tons of bowlders, large and small, covered the banks, and must be removed. To afford to visitors the convenience they would expect when driving there, a road round the reservoir had, from the first, been contemplated. Plans for the same had been prepared the previous year, and a grade adopted which would allow the mass of refuse, rejected by the engineers as unfit for use in the embankments, to be used in the foundation. Much of the material to be removed from the reservoir was blue gravel, which, with the cutting on the side of the hill, was sufficient in quantity to grade the road and cover the debris placed in the depressions. The entire work could be more economically and satisfactorily carried on by the city than, jointly, by the city and contractor. For a reasonable allowance that portion of the work the contractor was held to perform, was assumed by the Board, and he was released from further responsibility.

The drive around the reservoir is fifty feet wide and about one-half mile in length. In constructing it all the waste material taken from the reservoir was used in the foundation and covered with gravel. Two culverts were built to carry off the water shed by the slopes and road-bed.

The slopes of the reservoir banks are brought to grade, soiled and sown with grass seed. A walk nine feet wide is laid out on the top of the embankments and the margins are sodded.

During the winter that portion of the reservoir bank last finished has been washed by the rains and melting snows, and needs to be repaired. A portion of the road upon the hillside, left unfinished, should be completed. Drain-pipe should be laid at proper intervals, through the outer slopes of the reservoir banks, to carry off the rains and prevent washing. A paved gutter should be laid, to conduct the water shed by the slopes of the road and embankment, to the culverts. If this is neglected, the foot of the bank slopes will be washed out and much damage done. The expenditure required to complete the work will not be large, and we ask to be permitted to do it the present season.

The total expenditure for work done at the reservoir during the last season was as follows:

### PUDDLING OF RESERVOIR.

| | |
|---|---|
| Pay-roll of laborers, | $27,051 76 |
| Hauling gravel, | 3,177 48 |
| Hauling clay, (9,781 cubic yards), | 7,172 55 |
| *Carried forward,* | $37,401 79 |

| | | |
|---|---|---|
| *Brought forward,* | $37,401 79 | |
| Labor and coal, (pumping at clay pit), | 1,053 15 | |
| Lumber, tools and miscellaneous, | 1,389 52 | |
| Engineering, | 1,758 00 | |
| | | $41,602 46 |

### FINISHING RESERVOIR AND CONSTRUCTING ROADWAY.

| | | |
|---|---|---|
| Labor and teaming, | $9,260 77 | |
| Sodding, | 345 17 | |
| Tools, seed and miscellaneous, | 301 04 | |
| | $9,906 98 | |
| Deduct contractor's allowance, | 2,000 00 | |
| | | 7,906 98 |
| Total, | | $49,509 44 |

## SOURCES OF SUPPLY.

In our report for the year 1872, we presented a carefully prepared statement of the average daily supply of water to the city, the probable demand at the close of the year 1873, and invited the attention of the City Council to the inadequacy of the source upon which the city was then wholly depending.

From the statement then made we conclusively showed the unreliability of Breed's Pond as a source of supply for so large a number of takers as were then registered, and predicted its almost certain failure in a year of unusual drouth. We also urged the City Council to give early attention to the matter, and determine from whence a further supply should be obtained.

The relative value of the two sources which could be made available was somewhat fully discussed, and the preference of the Water Board indicated. The recommendation submitted to the City Council embraced the construction of three ample storage reservoirs, or artificial ponds, on the line of the flow of Birch, Penny and Hawkes' Brooks. The other source of supply considered was Flax Pond, and the series of ponds connected with it.

The city has not, fully, committed itself to either of these sources. Nor does the power reside with the City Council, at the present time, to appropriate either of them to the city's use. From whence the *permanent*, and *wholly adequate*, water supply of the city is to come should be definitely settled. One of the two sources named should be absolutely determined upon, after a full and *unpartisan* review of all the facts bearing upon the question.

To assist in forming a correct judgment as to the necessity for a further supply of water, and to aid in arriving at a decision as to the best method of increasing it, is the purpose of the remarks we now present for your consideration.

## BREED'S POND.

Breed's Pond, it is now well determined, will furnish an average daily supply of about one million gallons. Its storage capacity is about one hundred and fifty million gallons, and is ample for the quantity of water it receives.

At the beginning of the severe drouth of last summer the pond was nearly full, the depth of water at the dam being but four inches below the waste weir. From the first of June till the fifteenth of October, the quantity in store was increased by the amount of eleven and a half inches of rainfall upon its surface. This amount, together with the slight flow of the brooks which feed the pond, was probably only equal to the evaporation, so that during the four and a half months of drouth the entire supply to the city was furnished from the quantity in store on the first of June. The drouth increased the demand, and, as we predicted, the entire stock in store would have been required before the close of the season, except for the prudential measures adopted to lessen consumption. The depth of water at the gate house, at the former date, was seventeen feet four and a half inches, and at the latter date it had become reduced to six feet, while the area of the water surface was estimated at not more than twenty acres.

The rapid fall of the pond, during the months of July and August, convinced the City Council that this source of supply was practically exhausted; and that, to insure to the city an adequate supply for the coming year, another source should be provided. After much discussion as to the policy to be pursued, the two branches of the City Council authorized the Water Board to construct a storage basin in the valley of Birch Brook, and an order was passed, on the nineteenth of August, appropriating the lands necessary to be taken for that purpose.

## BIRCH POND.

The duty of constructing the new storage basin (now known as Birch Pond), having been assigned to the Water Board, we proceeded with as much despatch as possible to carry out the instructions contained in the order. Work was commenced about the first of September, and was continued until December; during which time a dam two hundred and ten feet long and sixteen feet high was constructed, nearly seventy acres of land were cleared, a new road half a mile in length was built, to take the place of that portion of the old county road now flowed, and over a mile of twenty-two-inch pipe laid to connect the pond with the well-chamber at the engine house.

The necessity for storing the earliest rains which should fall compelled a somewhat hurried performance of some portions of the work, more particularly that of clearing the land to be flowed. Had the action of the City Council permitted the Board to commence this work as early as the first of June, the prevailing drouth would have allowed of burning a considerable portion of the area cleared. A large amount of growing vegetation would thus have been destroyed and converted into a means of purification of the water when stored.

The construction of this storage reservoir was in accordance with the plan of increasing the water supply of the city suggested by the Water Board in their First Annual Report, and is the first of the series of ponds recommended to be made. The quantity of land appropriated by order of the City Council is ninety-two acres, sixty-seven of which will be flowed when the pond is full. Its capacity is 200,000,000 gallons, and it will have a depth of water, at the dam, of thirteen feet above the sill of the gate-house. The entire length of the pond is about one mile, and the circuit of the flow-line measures three miles. Its bed is remarkably level, showing a variation of only five feet for nearly its entire length, while its banks for the most part are abrupt, and thickly covered with wood. The watershed which surrounds and supplies it, has an extent of about five hundred acres, nearly all of which is wooded hillsides and uncultivated lands. The supply from this pond will be about a million gallons a day, as the territory draining into it affords a large percentage of the annual fall of rain. The abrupt hillsides which environ it, underlaid with ledge-rock and covered with bowlders, ensure the purity of the water when it shall be unaffected by the decomposition of vegetable matter, incident to the first storage of water upon new territory.

## PRESENT CONSUMPTION.

The demand for water is a constantly increasing one. During the year 1873, 562 applications for supply pipes were answered. The total *increase* in the number of water fixtures in use was 1884; while the *whole number*, on January 1st, 1874, was 6970. Of this number there were 1987 connected with bath-tubs, water-closets and hand hose. For the purposes for which these fixtures are used a large quantity of water is required, and each class has been increased during the year more than proportionally to the whole number of fixtures added; while the hand hose has been increased more than fifty per cent.

The books of the Water Registrar show that at the date above named the whole number of water takers in the city was 3400. This number will be added to during the coming season, and if we allow that the increase will be only two-thirds of the number of applicants during the past year, we shall have 3800 takers at the close of 1874. If each name upon the register represents five persons, we are now supplying water to 17,000 of our population, and at the close of the season, if our assumption proves correct we shall be required to meet the demands of 19,000.

We are not now obliged to estimate the quantity of water consumed. It is accurately measured and registered, and the average daily demand determined. For several months past a million and a quarter gallons a day have been drawn from the street mains. The actual consumption of water at the present time is at the rate of seventy-five gallons to each person represented upon our books, and more than forty gallons to every person in the city. If the moderate calculation we have made for new applications proves true, and the same rate of consumption is maintained throughout the year (and both are likely to be increased), at the close of the season the average daily consumption will be about 1,400,000 gallons. It is also to be borne in mind that for several months hand hose have not been in use, no water has been supplied for watering streets, and but little has been used for the extinguishment of fires.

## ADEQUACY OF THE SOURCES OF SUPPLY.

Breed's Pond and Birch Pond constitute the present water supply of the city. Their united capacity is a little less than two million gallons a day, in a year of *average* rainfall. We have already seen that the probable *demand* for water, at the close of the present year, will be about 1,400,000 gallons a day. The excess of supply over the demand will not therefore be large. "But if a drouth as severe as" that of the Summer of 1873 "should visit us the coming season, nearly the *entire* supply would be required; for as drouth prevails the demand for water increases." "For watering streets, gardens and lawns, the quantity used would be many times that" required in a year of frequent rains. "Wells would again become dry, and the resort of those who now depend upon them will be to the public water supply." Nor is such a contingency so remote that it need not be provided for. The *liability* to a short supply in a year of lowest rainfall is the contingency we are especially called upon to consider, and we repeat what we said a year ago, "that a water supply which, *at its minimum*, is not surely abundant, cannot be regarded as competent, and hazards the welfare of the community it was intended to protect."

The storage capacity of the two ponds is three hundred and fifty million gallons, and that of the distributing reservoir twenty millions. If there should be abundant rains during the spring months the water in store for the season which will follow, when the consumption is liable to be greater than the supply, will not be less than three hundred million gallons. This quantity will be fully adequate to any demand that may be expected in a very dry season; but should this reserve be largely drawn upon during the Summer season, the supply for the year 1875 will be almost wholly dependent upon the rainfall of that year.

## STORAGE.

Storage, in connection with a water supply, is only required when the sources of supply are not largely in excess of the daily consumption, and fail in the dry seasons. For such cases the storage needed is a reservoir, or pond, natural or artificial, of sufficient capacity to hold enough of the *excess* above *consumption*, in the *wet seasons* of the year, to insure an ample supply in *seasons of drouth;* or to husband enough of the *surplus above consumption*, in a *year of heavy rainfall*, to provide a sufficient supply in a year of *light* rains and consequent *low rate* of supply. To accommodate this general statement so as to express the requirement for storage with reference to the two sources now used by the city, we may say, that that amount is needed which will make *available* the *entire* supply to these ponds in a year of *lowest* rainfall. No community is protected from the dangers of a water famine when its supply, in any given year, depends upon a rainfall equal to the *average* rainfall in a series of years.

If the quantity of water required to supply our city during the year was equal to the *collectable* rainfall which can be gathered in our ponds, when the rains are equal to the *average* fall, there would be no surplus to be carried over to the succeeding year. Under such conditions, if the rainfall should be *below* the average, the city's supply would, in part, be furnished from the *quantity already in store.* But if a *severe* drouth should prevail, and the year should be one of *smallest* rainfall, the *entire* quantity in store might be consumed. As we have already said, the supply to the city in the year which will follow, would be wholly dependent on the rainfall of that year. But if that year should also be one of *low* rainfall, there must then be an insufficient supply, attended by all the discomforts which such a condition of things will bring. When, therefore, these conditions in regard to storage have been met, and the supply proves inadequate, it is because the *source* of supply is for the time exhausted. A short supply of water follows, not from *lack of storage capacity*, but from *want of water to store.*

Entertaining these views, the Water Board declined to increase the height of the dam at Breed's Pond last summer. Although urged by many citizens to "put up the dam," expecting thereby to increase the supply in the future, the plan was opposed by us as unwise, and certain to disappoint the expectation of those who desired it to be done. The misapprehension which then existed is removed, and those who were aggrieved at our decision now see that, in a season more than usually favorable for filling the pond, *it is not full, and will not again be*, so long as the city's supply is taken from that source. This fact justifies the action of the board and determines that the *largest* quantity of water that source can be made to supply is *already* secured.

The demand for water, and the adequacy of the sources of supply having been considered, the question again arises,

## FROM WHENCE SHALL A FURTHER SUPPLY BE OBTAINED?

In submitting our opinion we have to say, that during the past year this question has received from us the most careful attention. The two sources which have been proposed have been considered with reference to three important particulars, namely, the *quantity* of water obtainable, the comparative *purity* of the same, and the *expenditure* necessary to make either source available and place the waters so completely within the control of the city that all private rights connected with them shall be extinguished.

First, of the quantity. The only *measurement* of the watershed of Flax Pond and its tributaries which has ever been made, was conducted by Mr. McAlpine in 1870. Its area, as determined by unusually careful surveys, is about two and a half square miles. All engineers who make the construction of waterworks a specialty, agree in the opinion that not more than one-half of the annual rainfall can be collected and stored. Measurements of the quantity of water received into Cochituate Lake for a series of years, show that about *forty* per cent. of the rainfall upon its watershed can be made available. The tests which have been made by engineers who have had the continuous charge of water-supplies show that the amount of collectable rainfall is much smaller than the estimates of some of the older engineers, and that the range is between thirty-three and fifty per cent. The rugged hillsides which form, in large part, the drainage area of the sources we are considering will doubtless afford a large percentage of the annual rainfall, and our calculations will be based upon receiving into the storage reservoirs an average of a million gallons a day from each square mile that feeds them. Upon this assumption Flax Pond and its tributaries may be relied upon to supply two and a half million gallons a day, in a year of *average* rainfall. In connection with Breed's and Birch Ponds, which have a drainage area of something more than a thousand acres, a supply could be obtained, in an average year, of a little more than four millions a day.

From the territory draining into Hawkes and Penny Brooks as large a percentage of rainfall can be collected and stored as at Flax Pond. The engineer (George H. Bishop) employed to report upon the condition of these streams and the quantity of water they will furnish, states the area of territory draining into them to be four and a quarter square miles. We may therefore assume that four and a quarter million gallons a day can be obtained from these sources, which, added to the supply from Breed's and Birch Ponds, would increase the city's supply to six million gallons, or two million gallons a day *more* than can be obtained by adding Flax Pond to the present supply. So far as the *quantity* of water obtainable affects the question, the decision must be in favor of increasing the city's supply by taking these tributaries to Saugus River.

Our next inquiry relates to the quality of the water which can be obtained from the two sources. A decision upon this question should not be reached by appealing to the prejudices of the people, nor should any over-statement of facts bearing upon it be made. Heretofore we have purposely avoided the question we now propose to discuss. We presume all would agree, that if both of the sources we are now considering were equally removed from population and business, the waters of each collected into reservoirs, and the benefit resulting from storage obtained, no perceptible difference would be found in their waters. In other words, the gathering grounds from which these waters flow are substantially alike.

The water of Flax Pond is received into storage basins, partly natural and partly artificial, and there parts with most of the objectionable matter held in suspension. The color which the water in the streams that feed these ponds distinctly shows, is mostly disposed of while stored, and when discharged at the outlet of the lower pond the water is apparently clear and pure. While not as free from injurious foreign matter as the sources at Saugus, we do not doubt but that the water of Flax Pond, as it is delivered at the *outlet*, is as pure and satisfactory as that supplied to most cities.

But the question is not so much what is the purity of these waters *at the present time*, as what *will be* their condition in the near future. Flax and Sluice Ponds are within the settled limits of the city, as yet in the outskirts, but still in part surrounded by a permanent population. A part of the village of Gravesend and all of the village of Wyoma drain directly into these ponds. At present the contamination arising from these settlements may be inappreciable, but in a few years it will become more apparent, while no effective remedy can be devised to remove or avoid it. The contamination most to be feared is sewage matter, which, to a considerable extent, is now led into these ponds, and will increase as population increases upon their borders. The main thoroughfares through these villages lie directly upon the banks of these waters, and the narrow margin of land between the streets and ponds will soon be wholly occupied by dwellings and business places. Stables, privies, sink-drains and cess-pools are the accompaniments of settlement. The steep banks which encircle these ponds will readily conduct all the foulness of such places to the waters below. Water pipes have already been laid to both of these villages. "The introduction of water soon and rapidly increases the proportion of filth brought" to natural water courses. The drainage of Boston and Lynnfield Streets, much traveled highways, for two or three miles is directly into these ponds. Street drainage is a constantly increasing quantity. Every building erected and house-lot graded turns water into the streets which before soaked away where it fell, or evaporated. A heavy rain washes the dooryards of their foulness, and this, with the fecal matter of the streets, is swept to the ponds. "Between Sluice and Flax Ponds there is a dam and mill, now used for pulling wool and tanning sheepskins, and a large amount of polluted matter passes from these works into Flax Pond, which it would be necessary to discontinue. The natural drainage from the houses, etc., on the margin of Flax Pond, is into the pond. If the water is to be used for domestic purposes, a system of sewerage must be provided to divert it." *

A large portion of Pine Grove Cemetery is upon the watershed of Flax Pond, and naturally drains into Bacheller's Brook, which is one of the feeders of the pond, while the Catholic Cemetery is upon the borders of Sluice Pond. In addition to these unfavorable conditions, Flax Pond was for a long series of years the receptacle of the waste from the extensive dyeing establishment situated between the two ponds, and its upper portion is to-day a reeking mass of pollution. To the eye of the passer-by the rank grasses growing upon its surface indicate firm earth beneath, but, upon examination, acres of floating islands of filth will be found instead. In the warm months a green slime is generated which impregnates the entire body of the water. This is a regularly occurring phenomenon, although more apparent in some years than in others. During the past year, in the months of August and September, the condition of the pond was as we have here described it, and in the coves on

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* Kirkwood & Francis, on the value of Flax Pond as a water supply. Report to the Cochituate Board, 1874.

its easterly side this foulness, driven in by the winds, lay deep upon acres of its surface.

Such are the existing conditions which surround and affect these sheets of water. While the people of neighboring cities are discussing the nature of the impurities which find their way to the sources from which their water is drawn, and are devising means to divert them, and the State Board of Health sends out its yearly warning, "Beware of the sources of contamination to your water supplies!" we should avoid, if possible, accepting any source which, however pure at the present time, is threatened by so many causes of impurity as the one we have just considered.

The streams at North Saugus, the taking of which was recommended in our Annual Report for 1872, we now place in contrast. Four and a quarter square miles of territory drain into Hawkes and Penny Brooks. On the watershed of the former are only a few farms and a scattered population. No factories or business establishments invite settlement in the neighborhood. The population of the district has hardly increased in the last quarter of a century. No natural watercourse for miles around brings down a clearer or purer water than this. Nearly equal in quantity to the entire supply from Flax Pond, its water is gathered from a territory which imparts but little of the foulness of settled districts.

The latter brook is gathered from a wild, rocky, uninhabited region, with no traveled ways across its watershed, and free for many a score of years from all liability of settlement. Not an acre of cultivated land, nor a dwelling, is to be found on the two square miles of territory which feed the stream.

To gather these waters into reservoirs, and give to them the benefit resulting from storage, will furnish to the city an ample supply of the purest water that can be obtained. The slight discoloration now noticed will gradually disappear, and no annual outlay will be required to preserve from contamination the sources from which the supply to the city will be furnished.

The remaining consideration relates to the expenditure necessary to acquire either of the two sources we have considered, and to conduct their waters to the well-chamber at the engine-house. To insure the purity of the water in Sluice and Flax Ponds, a margin of land bordering upon their shores must be bought and placed under control of the city, or extensive and very expensive sewerage provided. A mile and a half of supply main must be laid, and connected with the pond at a level which will allow eight feet of water to be drawn from it. All the mill rights upon the streams must be purchased, and the rights of all persons in and to these waters must be extinguished.

To secure the sources at North Saugus will require the building of two storage reservoirs, the purchase of about one hundred and fifty acres of land, and the laying of a mile and a quarter of supply mains to connect the reservoirs with Birch Pond. To these expenses must be added the damages for diversion of water from the mills at Saugus Centre. The cost to the city of either of these sources cannot with accuracy be stated, and for obvious reasons no estimates are submitted.

We have now quite fully presented the facts which relate to the question of increasing the water supply of the city. The next step to be taken is one of much importance. A mistake at this juncture will not only be expensive and damaging to the interests of the city, but may convert a present success into failure. Economy of expenditure, as well as the prudence which has reference to the future while providing for the present, suggest that the additional supply of water to the city should be secured by following the recommendation submitted to the City Council a year ago. The successful gathering of the pond at Birch Brook demonstrates the practicablity of the plan we then proposed. If it be adopted, the city will secure a purer supply, in larger quantity and at a smaller cost, than will otherwise be obtained.

## WASTE OF WATER.

The quantity of water required to supply any community depends largely upon the economy with which it is used. People who rely upon wells for their supply draw but a few pailsful in a day. The trouble and labor of drawing water induces care in using it, and, in many instances, too great economy is practiced to ensure healthfulness and cleanliness to the household. In manufactories, workshops and business places, the supply is even more limited when it is obtained with difficulty. But a change to the abundant supply of water to be had by the mere opening of faucets, not only largely increases the legitimate consumption, but begets wasteful and extravagant habits. If all water takers would be reasonably prudent when drawing water for any purpose, and would promptly repair leaky fixtures to prevent waste, the city's consumption would be diminished at least one-third. But the economy which most people practice in their private affairs, is not regarded as a duty, except by a few, when dealing with the public. For this reason some stringent regulations should be adopted to protect the city from the abuses at present suffered.

## CAUSES OF WASTE.

The Cochituate Water Board were recently required to report "What changes are needed to prevent any waste of the present supply?" The Water Registrar, in a very satisfactory report upon the subject, replies "that the permanent and continual causes of waste are the use of hopper water-closets, so-called self-acting closets, urinals which are constructed for a continual run of water, the use of *hand hose for the purpose of irrigation*, *bad* plumbing material and *bad* plumbing work, and the steady run of water which is suffered in winter time to prevent freezing."

Meters were set to determine the quantity of water consumed by each kind of closet in use. In one instance five *hopper* closets consumed in a year 1,088,750 gallons, and by substituting *pan* closets a saving was made of 703,919 gallons. In another, there was supplied to three hopper closets, in a year, 1,255,470 gallons, and by substituting the pan closets a saving was made of 1,235,611 gallons. Other instances are given, and the results of the experiments with thirteen closets showed a saving of water, by the use of the pan closet, of 3,249,739 gallons in a year, "or a daily saving of 685 gallons for each closet, at the same time affording all the needed service."

### HAND HOSE.

With regard to the use of hand hose the same report says: "The season (last summer) was a dry one, and gardens and grass land were freely watered by hand hose, in a manner and to an extent *never contemplated as a use for hand hose;* besides, the rate of charges is in no way commensurate for such service." There were but 1318 hand hose in use by Cochituate water takers, and of this number 638 were upon premises containing from five thousand feet to five acres of land, in the Roxbury and Dorchester districts.

The premises in these districts, in regard to the size of house lots improved, resemble the estates in our city. A table is furnished showing the consumption in Boston for the four months (June to September, inclusive.) "when the call for domestic use is largely reduced by the absence of housekeepers from the city, and the first four months of the same year when the city's inhabitants were at home and a full supply for domestic purposes was required." The increase in consumption during the dry season was about twenty per cent. over that for the first four months of the year, and averaged 3,319,837 gallons a day. This increase is largely attributed to the use of hand hose for the irrigation of the lands in the two districts named. Lawns, flower and vegetable gardens consumed a large percentage of all the water used by hand hose. As the charges for the use of hose in Boston is five dollars a year, and for corner lots ten dollars, and as these charges are regarded "as in no way commensurate for such service," the insufficiency of the rate heretofore charged in our city, of only three dollars a year, is made quite apparent.

But the quantity of water used with hose depends upon the head with which it is delivered. Cochituate is supplied with a head of not more than one hundred feet, while the supply to our city is delivered with a head of one hundred and fifty feet. Our Superintendent states, in his report, as the result of actual test, that a 3-16 inch nozzle will deliver, in almost any section of our city, four hundred and fifty gallons of water an hour, and that if hose be used an hour a day for three and a half months, forty-seven thousand two hundred and fifty gallons of water will be used. The cost of pumping this quantity is greater than the city would receive from the rate charged. Under the same head an ordinary faucet will discharge twelve gallons of water a minute, and if allowed to waste ten minutes a day for a year the cost of pumping the water thus wasted will be more than the annual rate for such faucet.

## METERS.

During the past year several meters have been tested by the Superintendent, but none of them have been found accurate. The discrepancy is always in favor of the taker, and when meters are applied to determine the quantity of water used, the consumer may be sure that the register does him no injustice. However delicately constructed, it takes power to work them. So much water as is required to run the machinery is gain to the consumer; but as the register of a meter shows, substantially, the quantity of water which passes through it, unnecessary consumption will be checked, or the city will get pay for the water which, through carelessness or indifference, is wasted.

With this object in view, and to equalize in certain cases the rates charged, the Board have contracted for fifty meters of the Worthington pattern. These are to be applied to factories, workshops and other business places. The quantity of water used should determine the amount to be paid, but to set a meter for every service would be impracticable and costly. Only, therefore, where the quantity used is large, and more than the usual liability to waste exists, do we think it wise to apply them.

The lowest rates for metered water, in any city having rates, is two cents a hundred gallons. The daily supply to the city, at the present time, is a million and a quarter gallons, and if paid for at the lowest rate it would return to the city $91,250. Not much more than one-half of this sum is realized. By the employment of meters the city may hope to increase its receipts and lessen the consumption.

We have a supply of about 2,000,000 gallons a day. To husband it by checking unnecessary consumption, is the same as to increase the supply. To add another source to those we have, which shall be adequate for the future wants of the city, will cost a quarter of a million dollars. By postponing so large an expenditure, even for a few years, the city will save an annual interest of at least $15,000. A reasonable economy in the use of that we have will ensure this saving.

## RECEIPTS.

The receipts of the department for the past year were $52,552.06,. Deducting $4,559.45, received for putting in extra service pipe, the water rents are found to be $47,992.61. This sum includes all charges made and allowed for public water, which amounts to about $12,000. The increase of cash receipts from private takers, as compared with the year 1872, has been $10,588.10, and there remained uncollected at the close of the year $3,393.89, making the total increase in the amount of water rates assessed, $13,981.99.

A rule adopted by the City Treasurer for the year 1872, requires the Water Department to be charged with an interest, at the rate of six per cent. per annum, on the water debt as it stands on the Treasurer's books at the commencement of each municipal year. Under this rule the department will be regarded as self-sustaining, when its receipts in any year, are equal to the interest charged against it and the cost of maintenance. If the income be less than the sum of these two charges, the deficiency will be carried to account of construction.

## CHARGES FOR PUBLIC WATER.

If assessments had been made to all water-takers for the years 1870–71, and a reasonable allowance had been made by the city for public uses from the time of the earliest expenditure in 1869 to the commencement of the year 1873, (the date of first allowance by the city for public purposes) the income of the department, to date, would have been larger than the charges against it. The rule adopted by all cities and towns having a public water supply, of making a proper allowance for public water, has been somewhat questioned in our city. But the correctness of the rule will be admitted, we think, upon due consideration. Either water should be supplied free to all takers, public and private, or all consumers should pay proportionately. The assessments for water, taking a series of years into the account, are intended to meet the expenses for maintenance and interest, and to provide a sinking fund for the extinguishment of the water debt. To the extent that the city, in its corporate capacity, uses the water, it should contribute. A large portion of the aggregate expenditure, on account of the introduction of water, has been used in furnishing facilities for the extinguishment of fires. Miles of pipe have been laid and hundreds of hydrants set for this purpose alone. All parts of the works aid in furnishing this protection to property. To provide security against disaster from fire, is, to a certain extent, an acknowledged public duty, and as such security is for all alike, so the expense of providing it should be from the common fund, the treasury of the city.

The water-works of the city not only provide additional security against loss of property by fire, but they greatly diminish the expenses of the Fire Department. The number of its members is smaller and its equipment less costly. The construction of reservoirs for fire purposes has been abandoned, and the reservoir at Pine Hill feeds the hydrants, located at almost every street corner, with a never-failing supply of water. To provide by taxation for the expense of maintaining these advantages, is as legitimate as the tax for the maintenance of common schools. Consumers of water for domestic and business purposes, ought not to be required to pay any portion of the expense for providing the additional security enjoyed by the public; for they, in common with other citizens, contribute by their annual tax their full share of the public expenses.

## EXPENDITURES FOR THE YEAR 1873.

There was paid on account of construction and maintenance during the past year $198.012,42. The bills approved by the Board include the outlay for the extension of the works, the building of the Birch Pond reservoir, and payments on account of the pumping engine and engine house. The cost of maintenance, including interest, was $53,214.16, which sum is $662.16 less than the gross receipts for the year.

## COST OF THE WORKS.

The net cost of the water-works of the city, as shown by the books of the Clerk of the Board, has been $834,994.46. Demands on account of land damages at Birch Pond, and for the laying of the supply main from the pond to the engine house, are yet to be paid. These demands, with the unsettled balances now due on account of construction, will increase the total cost of the works to nearly $900,000.00. To enable the Board to settle all outstanding demands, and to provide for such extension of the works as the City Council may order, an appropriation will be necessary Of the $800,000 of bonds authorized to be issued on account of the construction of the works, $100,000 remain. We respectfully ask that the City Treasurer may be authorized to issue bonds for that amount and that the receipts of the sale may be placed to the account of Introduction of Water.

## CONCLUSION.

Four years have passed since the work for supplying the city with water was commenced. The undertaking was begun at a time when many citizens questioned the necessity for an extended system of supply, and doubted the policy which was to commit the city to so large an expenditure. But the most earnest and confident among those who gave countenance and support to the measure have realized their largest expectation. With a lower rate of assessments than is maintained in most cities, the annual receipts have already reached a sum which nearly discharges the interest on the cost of the works and the expenses of maintenance.

From year to year the works have been extended until they now reach every section of the city. The residents upon almost every accepted street in the city have an abundant supply of good and wholesome water. The facility with which every house, factory or business place can be supplied, adds to the comfort and convenience of all classes in the community. It lessens the labor of the housewife in her busy round of duties, promotes cleanliness, gives an increased value to property, and makes our city, either as a place for residence or for business, more desirable. The effectiveness of our fire department at fires, has been greatly increased, and the property of our citizens has become more secure. The best safeguard against a sweeping conflagration, disastrous alike to individuals and to the community, is provided. Rates of insurance, however high they may seem, are lower than they would otherwise be, and a feeling of security against serious loss by fire relieves owners of property from the constant dread of an impending calamity. And for these advantages the taxes of our citizens are not increased, except as the low charges for public water affect the rate of taxation. The expenditure which has been made to provide them, appears as a large part of our city indebtedness, but the burden of the debt, if such it be, is borne only by those who elect to carry it.

In submitting our report the Board take great pleasure in saying that every part of the works are in excellent condition. The supply of water is abundant, the reservoir at Pine Hill is wholly serviceable, the pumping engine is performing its work with an economy of fuel never equaled in this country, and the supply, distributing and service pipes, and fire hydrants, are all in the completest order.

On behalf of the Public Water Board.

EDWIN WALDEN, *President.*

# REPORT OF THE SUPERINTENDENT.

*To the President of the Public Water Board:*

*Sir*—I have the honor to present herewith the Annual Report of the Superintendent for the year ending December 31st, 1873.

## PONDS.

The long season of dry weather in the Summer and Fall tested Breed's Pond to its utmost capacity, and reduced it, at the lowest point, to only six feet above the sill of the gate-house, or above the bottom of the outlet pipe. It reached the lowest point on the 7th of November; on the 8th it began to rise and has continued to rise, with slight intermission, ever since. On the first of January the water stood at 10 feet 8 inches. From the margin of the pond, below high water mark, all dead trees and shrubs have been removed and the brooks running into the pond have all been cleared during the past season.

A new dam has been built at Birch Pond by which some sixty-seven acres of land will be flowed, a pipe twenty-two inches internal diameter has been laid to the engine-house, and all the connections at the pond and well-chamber have been made, and ready for use. The pond is rising steadily, the depth at the gate-house, on the first of January, was 8 feet 5 1-2 inches.

## RESERVOIR.

During the Summer the entire bottom of the reservoir has been carefully and thoroughly puddled. When first filled, after the puddling was finished, it appeared still to leak, but after the water had been standing a few days the leak began to decrease, showing that it was occasioned by the drying and cracking of the puddle by the sun, and that by being kept covered with water it would become in a short time perfectly tight. Observations carefully taken and continued several weeks confirmed this opinion, the leak in the bottom having almost entirely ceased. When first filled to fourteen feet, on the 18th of December, the sides of the embankment, which had lain dry over two years, appeared to leak; the loss of water from that cause is now decreasing, and there is no doubt that after the water has been kept at high water mark a few months the loss from absorption and percolation will cease.

## PIPES.

The Force main is in good condition and has never shown any signs of leak. The distributing mains are now in good condition. There have been sixty-eight leaks in the pipe, sixty-one leaks in hydrants and eight leaks in gates, all of which have been repaired by the contractor without expense to the city. As the time will soon expire in which the contractor is responsible for the repairs of the street mains, I would respectfully suggest the necessity of soon providing a suitable repair shop, with pipe yard and sheds attached, where the necessary tools and implements may be kept, and proper provision made to meet any emergency which may arise.

There have been laid this year, in different parts of the city, 17,322 feet of distributing mains; 1,854 feet of service mains in courts, and 5,851 feet of twenty-two-inch pipe, to connect Birch Pond with the well chamber. Before connecting the latter the pipe was thoroughly flushed out by letting the water in from the pond. Nineteen gates and twenty additional hydrants also have been set. One stand pipe for fire purposes; three stand pipes for water carts, and 562 service pipes have been put in this year, amounting to 23,785 feet, making the total length of service pipe laid in the city 117,335 feet.

## PUMPING.

The new engine which was being put up at date of last Annual Report was so far completed as to be started on the 14th of January, 1873. After a few days' trial it was stopped to make some small alterations, and commenced running again on the 26th of February. On the 27th of February the water was let into the pipes from the reservoir for the first time, and the new engine continued to furnish the supply for the city while the Worthington pump was being removed from the old pump-house near the pond and set up at the new house. On the 5th of April the reservoir was shut off and the city was supplied by the Worthington pump; the new engine was started again on the 5th of May for the regular supply of the city, and continued to work steadily, showing fine results, until the 4th of October, when the Worthington pump was again brought into use, to supply the city while the new engine was being examined, ready for a test trial. On the 12th of November the new engine was started up and the water let on to the city from the reservoir, and it has continued to furnish the supply to the city to the present time; and unless something unusual should occur the supply will not again be interrupted. On the 10th, 11th, and 12th of December a test trial was made by a committee of experts, for both duty and capacity, which showed very high results, and places the machine, for economy of fuel, above any pumping engine in this country; the duty being 103,923,215 foot pounds, equal to 1,246 gallons of water raised 100 feet per pound of coal. The record for the month of December has been as follows:

The engine was run 223 hours and 45 minutes, making 237,844 revolutions, using 75,900 pounds of coal for generating steam and banking fires. The average duty for the month, calculated from the estimated load on the pump, and the gross amount of coal used for firing and banking, no deduction being made for ashes or cinders, 84,890,504 foot pounds. The actual quantity of water delivered into the reservoir, allowance being made for loss of action in the pump, 44,369,798 gallons, or 584.58 gallons for each pound of coal consumed, equal to raising 977.67 gallons one hundred feet high per pound of coal.

## USE OF WATER.

On account of the large quantity of water used through the dry weather last Summer, it was found necessary to prohibit the use of hand hose and to shut the water off from the city during the night; by adopting these precautions a water famine was prevented. With the additional supply to be obtained from the new pond there can be no danger apprehended for the coming year, still I would most respectfully call your attention to the necessity of more stringent regulations to prevent the waste of water. It costs the city, to deliver the water to the citizens, at the rate of 15.8 cents per 1,000 gallons when pumping 1,250,000 gallons per day. The smallest size hose nozzle (3 1-6 inch) will deliver, with 150 feet head, 450 gallons per hour; if used an average of one hour per day for three and a half months, 37,250 gallons of water will be used, which costs the city $7.46, and for which it receives only $3. An ordinary faucet will deliver, with the same head, twelve and a half gallons per minute, and if allowed to run to waste, an average of only ten minutes per day for a year, will waste an amount of water which costs the city $7.21 to deliver.

Respectfully submitted.

DANIEL WALDEN, *Supt.*

# TABLE I.

## SHOWING THE AMOUNT OF PIPE LAID IN 1873.

| NAME OF STREETS. | | | SIZE OF PIPE. | | | |
|---|---|---|---|---|---|---|
| Street. | From | To | 22 In'h. | 8 In | 6 Inches. | 4 Inch. |
| Cottage | Western Avenue | Water Hill | | | 1758.4 | |
| Hood | Cottage | Allen | | | | 1138.8 |
| Light | Summer | West Neptune | | | | 791.9 |
| West Neptune | Light | | | | | 316.6 |
| Alley | Pleasant | Blossom | | | | 590. |
| Norwood Court | North Franklin | | | | | 393. |
| Mailey and Ezra | Union | Pinkham | | | | 844.3 |
| Union Court | Union | | | | 624. | |
| Sheridan | Essex | | | | | 761.9 |
| Larrabee's Court | Lewis | | | | | 390.3 |
| Chatham | Collins | Court | | | 2631.4 | |
| Marianna | Chatham | Jackson | | | 1024. | |
| Chestnut | Maple | Western Avenue | | | 474. | |
| Bowler | Chestnut | Maple | | | | 1317.9 |
| Rand | Chestnut | | | | | 984.5 |
| Chestnut | Lake | Boston | | | 473.4 | |
| Boston | Chestnut | Lynnfield | | | 2457. | |
| East Charles | Howard | | | | | 244.6 |
| Fayette Place | Fayette | Gold Fish Pond | | | | 89. |
| Shepard | | | | | | 10.6 |
| Jackson | | | | 8 | | |
| | Birch Pond | Engine House | 5833 | | | |
| | | | 5833 | 8 | 9442. | 7872.4 |

## AMOUNT OF PIPE LAID IN COURTS IN 1873.

| Name of Court. | Size. | Length. |
|---|---|---|
| Henry Avenue extension | 1½ | 208. |
| Thompson's Court | 1¼ | 168.6 |
| Bruce's Court | 1½ 1¼ 1 | 474.2 |
| Breed's Square | 1¼ | 157. |
| Western Avenue | 1¼ | 174.4 |
| Corbet Place | 1¼ | 179.1 |
| Norcross Court | 1½ | 210.6 |
| Houghton Court | 1½ 1¼ 1 | 282.9 |
| | | 1854.4 |

### TOTAL AMOUNT OF PIPE LAID IN THE CITY TO JAN. 1, 1874.

| | |
|---|---|
| 22-inch pipe laid in 1873 | 5833. |
| 8-inch pipe laid in 1873 | 8. |
| 6-inch pipe laid in 1873 | 9442. |
| 4-inch pipe laid in 1873 | 7872.4 |
| Pipe laid in Courts in 1873 | 1854.4 |
| | 25,009.8 |

Total amount of pipe laid in 1873, 25,009 feet 8 inches, equal to 4 miles, 3,889 feet and 8 inches. Previously laid, 41 miles, 4,704 feet and 10 inches. Total amount of pipe laid 46 miles, 3,314 feet and 6 inches.

## TABLE II.

### SHOWING THE NUMBER AND LOCATION OF HYDRANTS SET IN 1873.

1. Corner Cottage and Water Hill Streets.
2. Corner Cottage and Hood Streets.
3. Corner Neptune and Light Streets.
4. On Alley Street, between Blossom and Pleasant Streets.
5. Middle of Norwood Court.
6. On Ezra Street, opposite Mailey.
7. Middle of Union Street.
8. Sheridan Street, near Chestnut Court.
9. End of Larrabee's Court.
10. On Chatham, opposite New Chatham Street.
11. Middle of Chatham Street.
12. Corner Chatham Street and Oakwood Avenue.
13. Corner Marianna and Chatham Streets.
14. Corner Marianna and Henry Streets.
15. Corner Chestnut Street and Western Avenue.
16. Middle of Bowler Street.
17. Middle of Rand street.
18. Corner Chestnut and Boston Streets.
19. Corner Boston and Hudson Streets.
20. Corner Lynnfield and Boston Streets.

| | |
|---|---|
| Hydrants previously set | 327 |
| Hydrants set in 1873 | 20 |
| Total number of hydrants | 347 |

# TABLE III.

## SHOWING THE NUMBER AND SIZE OF GATES SET IN 1873.

| Street. | No. | Size. | Street. | No. | Size. |
|---|---|---|---|---|---|
| Cottage | 1 | 6 | Chestnut | 1 | 6 |
| Hood | 1 | 4 | Bowler | 2 | 4 |
| Light | 1 | 4 | Rand | 1 | 4 |
| Alley | 1 | 4 | Boston | 1 | 6 |
| Norwood Court | 1 | 4 | Fayette Place | 1 | 4 |
| Mailey and Ezra | 1 | 4 | | | |
| Union Court | 1 | 6 | | 19 | |
| Sheridan Street | 1 | 4 | Previously set | 283 | |
| Larrabee's Court | 1 | 4 | | | |
| Chatham | 2 | 6 | Total | 302 | |
| Marianna | 2 | 6 | | | |

# TABLE IV.

## SHOWING HEIGHT OF WATER AT BREED'S POND, ABOVE SILL OF GATE-HOUSE, EACH SATURDAY DURING THE YEAR 1873. TOP OF WASTE WEIR 17 FEET 8 1-2 INCHES ABOVE SILL OF GATE-HOUSE.

| Date. | Feet. | In. | Date. | Feet. | In. | Date. | Feet. | In. | Date. | Feet. | In. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. 4 | 17 | 8¾ | April 5 | 17 | 8½ | July 5 | 14 | 3½ | Oct. 4 | 6 | 7½ |
| 11 | 17 | 10 | 12 | 17 | 10½ | 12 | 13 | 7½ | 11 | 6 | 7 |
| 18 | 17 | 8¼ | 19 | 17 | 10¼ | 19 | 13 | 1 | 18 | 6 | 1 |
| 25 | 17 | 9¾ | 26 | 17 | 8¼ | 26 | 12 | 6 | 25 | 6 | 1½ |
| Feb. 1 | 17 | 9¾ | May 3 | 17 | 8¾ | Aug. 2 | 11 | 11¼ | Nov. 1 | 6 | 3 |
| 8 | 17 | 10 | 10 | 17 | 9¼ | 9 | 11 | 3¾ | 8 | 6 | 2½ |
| 15 | 17 | 7 | 17 | 17 | 8¼ | 16 | 10 | 9½ | 15 | 6 | 7½ |
| 22 | 17 | 5½ | 24 | 17 | 8¼ | 23 | 10 | 7 | 22 | 8 | 6 |
| M'ch. 1 | 17 | 8½ | 31 | 17 | 4½ | 30 | 10 | 0½ | 29 | 10 | 0½ |
| 8 | 17 | 8½ | June 7 | 16 | 8¼ | Sept. 6 | 9 | 11½ | Dec. 6 | 10 | 3½ |
| 15 | 17 | 8½ | 14 | 16 | 2½ | 13 | 9 | 3¼ | 13 | 9 | 7 |
| 22 | 17 | 8½ | 21 | 15 | 5½ | 20 | 8 | 8 | 20 | 10 | 4 |
| 29 | 17 | 8½ | 28 | 14 | 9¾ | 27 | 7 | 2¼ | 27 | 11 | 0 |

# TABLE V.

## SHOWING THE AMOUNT OF RAINFALL AT THE PUMPING STATION IN INCHES, FOR 1873.

| Date. | | Amount. | Date. | | Amount. | Date | | Amount. |
|---|---|---|---|---|---|---|---|---|
| Jan. | 3 | .364 | April | 13 | 1.312 | Sept. | 7 | .084 |
| | 5 | 1.5 | | 18 | .631 | | 14 | .057 |
| | 8 | .353 | May | 3 | 2.078 | | 19 | .76 |
| | 13 | .053 | | 9 | .3 | | 23 | .449 |
| | 17 | .7 | | 13 | .21 | | 29 | .17 |
| | 18 | .466 | | 21 | .36 | October | 15 | .327 |
| | 21 | .214 | June | 7 | .295 | | 17 | 1.826 |
| | 24 | .6 | | 28 | .462 | | 20 | 1.37 |
| | 27 | .464 | July | 1 | .216 | | 27 | .7 |
| Feb. | 3 | .002 | | 3 | .152 | | 31 | .057 |
| | 7 | .514 | | 11 | .07 | Nov. | 8 | .75 |
| | 16 | 1.1 | | 17 | 1.986 | | 12 | .367 |
| | 19 | .101 | | 27 | .15 | | 16 | .4 |
| | 20 | .6 | August | 1 | .12 | | 18 | 1.718 |
| | 26 | .1 | | 14 | 1.1 | | 24 | 1.5 |
| March | 3 | .2 | | 15 | 1.07 | Dec. | 2 | .23 |
| | 11 | .332 | | 18 | 1.276 | | 13 | 1.16 |
| | 15 | .048 | | 21 | .446 | | 19 | .58 |
| | 18 | .072 | | 23 | .107 | | 26 | .6 |
| | 20 | 2.17 | Sept. | 1 | 1.52 | | 28 | 1. |
| | 26 | .27 | | 4 | .5 | | | |
| | 31 | .356 | | 6 | .413 | | | |

| | |
|---|---|
| Rainfall for the month of January | 4.714 |
| Rainfall for the month of February | 2.417 |
| Rainfall for the month of March | 3.448 |
| Rainfall for the month of April | 1.943 |
| Rainfall for the month of May | 2.948 |
| Rainfall for the month of June | .757 |
| Rainfall for the month of July | 2.574 |
| Rainfall for the month of August | 4.119 |
| Rainfall for the month of September | 3.953 |
| Rainfall for the month of October | 4.280 |
| Rainfall for the month of November | 4.735 |
| Rainfall for the month of December | 3.57 |
| Total rainfall for the year | 39.458 |

## *SCHEDULE OF STOCK AND TOOLS, JAN. 1, 1874.*

1 lining machine, complete.
70 shovels.
53 picks.
13 bars.
3 striking hammers.
2 sledge hammers.
2 spoons. 2 hoes. 2 rakes.
7 drills.
11 pairs pipe-tongs.
2 monkey wrenches.
4 pipe cutters.
3 die stocks and dies complete.
1 tap wrench and set of taps.
2 bench vises.
6 soldering irons.
1 melting pot and ladle.
1 solder pot and mould.
8 drills and stuffing boxes for tapping pipe.
1 brace.
3 gate wrenches.
3 service wrenches.
3 hydrant wrenches.
2 tape measures.
6 rammers. 3 paving hammers.
1 varnish pot and three brushes.
4 paving hammers.
2 nail hammers.
2 trowels.
2 hand saws.
1 axe.
1 stove and pipe.
3 kettles for thawing out pipe.
1 force pump for thawing out pipe.
140 feet ¼-inch pipe for thawing out pipe.
50 feet rubber hose.
6 pairs rubber mittens.
1 lamp. 6 lanterns.
3 oil cans.
2 benches.
1 tank.
1 sink.
2 wheel-barrows.
1 hand-cart.
1 tool box.
2 fire pots.
2 horses.
1 large wagon and harness.
1 light wagon and harness.
1 pung.
355 feet 2-inch iron pipe.
510 feet 1½-inch iron pipe.
322 feet 1-inch iron pipe.
48 feet 1¼-inch iron pipe.
463 feet ¾-inch iron pipe.
94 feet 1-inch galvanized pipe.
140 feet 5-8-inch lead pipe.
71 stop and wastes.
82 corporation stops.
7 connections.
110 pounds solder.
18 hydrant cocks and nipples.
44 hydrant covers.
12 hydrant boxes.
20 unions.
434 T's.
241 elbows.
26 reducers.
571 couplings.
14 12-inch files.
109 caps.
233 plugs.
43 right and left couplings.
37 bushings.
4 hydrant rods.
2 service covers.
2 barrels cement.
100 bushels charcoal.
80 pounds nails.
1 ton coal.
3 gallons lard oil.
10 gallons black varnish.
3 gallons spirits turpentine.
1 12-inch gate.

### SPARE TOOLS AT ENGINE HOUSE.

24 brush hooks.
7 scythes and snaiths.
8 rakes. 7 axes. 12 mattocks.
168 shovels. 48 spades.
87 picks and handles.
43 hand drills. 3 ledge drills.
37 half rounds. 100 wedges.
2 striking hammers.
3 hand hammers.
1 sledge hammer.
2 iron bars.

## FURNITURE, TOOLS AND SUPPLIES AT ENGINE HOUSE.

1 table.
1 clock.
1 feather duster.
5 chairs.
1 dust brush and pan.
3 slates.
9 brass lamps and brackets.
3 thermometers.
3 lamps.
2 lanterns.
1 platform scale.
3 dozen lamp wicks.
3 dozen lamp chimneys.
4 brooms.
4 ladders.
2 pails.
2 indicators.
5 oil cans.
1 set oilers.
2 coal shovels.
1 set taps and dies.
1 hydrant wrench.
1 breast drill.
1 ratchet and set of drills.
2 set fire tools.
1 wheel-barrow.
4 gate keys.
1 service key.
2 monkey wrenches.
13 S wrenches.
2 copper hammers.
1 vise and bench.
1 screw driver.
2 crow-foot wrenches.
3 socket wrenches.
2 spanners.
1 tallow pot.
1 hatchet.
1 pair blocks and rope.
8 pounds polishing powder.
5 gallons lubricating oil.
20 gallons cylinder oil.
7 pounds Martin's blacking.
1 cord slabs.
27 pounds hemp.
10 pounds cotton waste.
1 ton Cumberland coal.
50 tons anthracite coal.
3 extra valves for air pump.
6 extra valves for pump.
7 eye bolts.
6 gauge cocks.
6 valves.
3 unions.
3 dozen springs for Worthington pump.
100 feet cotton hose and pipe.
150 feet small rubber hose.
3 pounds black lead.
Box of odd bolts.
1 spare No. 1 Blake pump.

# REPORT OF THE CLERK.

*To the President of the Public Water Board:*

*Sir*—I have the honor to submit herewith the Annual Report of the Clerk, for the year ending December 31st, 1873.

The number of services, January 1st, 1873, was 2,194, discontinued one; new services added this year 562, making a total, on the first of January, 1874, of 2,755. We are now supplying 2,051 dwellings, occupied by 2,814 families, and 67 boarding houses; 131 stores; 4 hotels; 136 stables; 115 shoe factories; 12 morocco factories; 6 planing mills; 27 school houses; 7 churches; 4 fire engine houses; 5 bakeries; 45 steam engines; 4 blacksmith shops; 3 printing offices; 3 public halls; City Hall; 2 market houses; 6 green houses, and 6 fountains. The increase in fixtures has been as follows:

| | 1872. | 1873. | Increase. |
|---|---|---|---|
| Faucets, | 3907 | 5012 | 1105 |
| Bath tubs, | 152 | 265 | 113 |
| Water closets, | 408 | 736 | 328 |
| Hand hose, | 628 | 966 | 338 |

During the Summer every house having a service was visited, and a correct list of the fixtures obtained. The water has been turned on to 628 services, and shut off from 164; 132 have been shut off for non-payment or violation of the rules, and 60 have been let on again. By instructions from the Board the rules, in relation to shutting off the water for non-payment, have not been rigidly enforced this term on account of the great depression in business. There is now due for the current term $3,393.89 for water, and $1,773 90 for extra pipe, &c.

The total receipts for the year have been as follows:

| | | |
|---|---|---|
| Received for water rates | $46,680 32 | |
| Received for water carts, | 1,084 41 | |
| Received for building purposes, | 107 88 | |
| Received for fines, | 120 00 | |
| | | $47,992 61 |
| Received for extra pipe, | $4,189 45 | |
| Received for wood, | 370 00 | 4,559 45 |
| Total am't of receipts for the year 1873, | | $52,552 00 |

All of which has been paid into the City Treasury.

INCREASE OVER 1872.

| | |
|---|---|
| Amount received for water, less $10,000 on account of fire hydrants, | $37,992 61 |
| Amount received for water in 1872, less $8,989 belonging to 1871, | 27,404 51 |
| Increase in cash receipts, | $10,588 10 |
| Add amount now due, | 3,393 89 |
| Total increase over 1872, | $13,981 99 |

## *EXPENDITURES FOR THE YEAR 1873.*

### CONSTRUCTION.

| | | |
|---|---|---|
| Engine house, | $6,834 81 | |
| Engine, | 10,662 00 | |
| Reservoir and land, | 65,845 19 | |
| Birch pond, | 22,966 97 | |
| Distributing mains, hydrants and gates, | 23,914 81 | |
| Service pipes, | 14,574 48 | |
| | | $144,798 26 |

### MAINTENANCE

| | | |
|---|---|---|
| Salaries and office expenses | $3,211 89 | |
| Repairs, labor, material, &c., | 2,475 50 | |
| Pumping, wages, coal, oil, waste, &c., | 10,825 10 | |
| Interest account, | 36,701 67 | |
| | | $53,214 16 |
| Total expenditures, | | $198,012 42 |

### CREDIT.

| | | |
|---|---|---|
| By amount received for water | $47,992 61 | |
| By amount received for extra pipe, | 4,189 45 | |
| By amount received for wood, | 370 00 | |
| | | 52,552 06 |
| Net expenditures, | | $145,460 36 |

## TOTAL EXPENDITURES TO JAN. 1st, 1874.

| | | |
|---|---|---|
| Breed's pond and buildings, and repairing dam, | $30,237 16 | |
| Reservoir and land, | 126,545 19 | |
| Engine house and land, | 54,293 83 | |
| Engine and boilers, and Worthington pump, | 56,618 25 | |
| Force main, | 23,814 00 | |
| Distributing mains, hydrants and gates, | 437,457 21 | |
| Service pipes, | 78,897 64 | |
| Engineering, | 8,464 99 | |
| Birch pond, | 22,966 97 | |
| Maintenance and interest, | 98,440 70 | |
| | | $937,735 94 |

### CREDIT.

| | | |
|---|---|---|
| Total receipts, 1872, | $50,189 42 | |
| Total receipts, 1873, | 52.552 06 | |
| | | $102,741 48 |
| Net cost of works, Jan. 1st, 1874, | | $834,994 46 |

Respectfully submitted.

DANIEL WALDEN, *Clerk.*

# TABLE,

*Showing the Performance of the Pumping Engine at the Lynn Water Works for the four months ending March 31st*, 1874.

| | Dec. 1873. | Jan. 1874. | Febru'ry. | March. |
|---|---|---|---|---|
| Number of revolutions, | 237,844 | 270,300 | 242,812 | 255,733 |
| Pounds of coal used for firing and banking, | 75,900 | 91,770 | 78,900 | 80,100 |
| Number of gallons pumped into the reservoir, allowing 4 per cent. for loss of action in the pump, | 44,369,798 | 50,424,465 | 45,296,578 | 47.706,991 |
| Average lift in feet, including friction, | 167.24 | 164.00 | 164.15 | 164.08 |
| Number of gallons delivered into the reservoir, per pound of coal, | 584.58 | 549.46 | 571.10 | 595.59 |
| Number of gallons raised 100 feet high, per pound of coal, | 977,67 | 901.12 | 942.39 | 977.24 |
| Duty in foot pounds per 100 pounds of coal, calculated from the pressure as shown by the gauge and the total amount of coal used for firing and banking, no deduction made for ashes or cinders, | 84,890,504 | 78,248,097 | 81.826,614 | 84,852,803 |

## COST OF PUMPING.

| | |
|---|---|
| Coal for firing and running, 306,520 pounds, at $7.50 per net ton, | $1,149 45 |
| Coal for banking, 20,150 pounds, at $8.50 per net ton | 85 64 |
| Wood, 2 cords, at $11 per cord, | 22 00 |
| *Coal for heating, 39,300 pounds, at $7.50 per net ton, | 147 49 |
| Oil, waste, packing and stores, | 65 06 |
| Repairs to engine | 10 75 |
| Repairs to boilers, | 164 97 |
| Engineer and fireman, | 650 00 |
| | $2 295 36 |

| | |
|---|---|
| Cost of raising 1,000,000 gallons into the reservoir | $12 22 25-100 |
| Cost of raising 1,000,000 gallons one foot high | 7 41-100 |
| Cost of coal for raising 1,000,000 gallons into reservoir | 6 90 68-100 |
| Cost of coal for raising 1,000,000 gallons one foot high | 4 15-100 |

DANIEL WALDEN, *Supt.*

Lynn, April 10th, 1874.

---

*Building heated by a separate boiler.

# Practicability of the Plan

FOR

# INCREASING THE WATER SUPPLY.

---

The Public Water Board having had occasion, during the present season, to consult, professionally, Mr. Joseph P. Davis, Engineer in Chief of the Cochituate Water Works, Boston, they invited that gentleman to consider the plan of increasing the water supply of the city, recommended to the City Council by the Board in their report herewith submitted. His opinion of the practicability of the plan presented, and of the value of the streams at North Saugus as additional sources of supply, will be found in the subjoined letter:

BOSTON, April 2, 1874.

*To the President of Public Water Board.*

DEAR SIR:—During a recent visit to the grounds from which it is proposed to take a supply of water in extension of your present works, you requested me to give, in writing, my opinion in regard to the feasibility of constructing works for conducting and the storage of the water, and of the character of the water that would be collected. In response to that request I have to say:

The surface of the drainage area is mostly rock, or thin strata of earth underlaid by rock, and consequently is of a character to collect and deliver up a very high percentage of the rainfall, as your experience with the collecting grounds of Breed's Pond has proved. I should judge that fully sixteen inches in depth might be collected and rendered available in the year of greatest drouth. Many engineers would estimate upon a still greater depth, say eighteen inches; but in so important a matter as a supply of water for domestic and trade uses, where an interruption to it for a few days only would temporarily paralyze all business, and the feeling of a possibility of a scarcity of water, even in the somewhat distant future, would beget an uneasiness in the community, and oftentimes deter persons from establishing manufactories which would be dependent upon a constant and abundant supply, it is best to keep within safe limits in estimating the least yield.

The topography of the ground is quite favorable for the construction of comparatively capacious and deep storage basins at a moderate cost. By building two inexpensive dams, one on Hawkes Brook, the other on Penny Brook, two basins can be formed, which, in connection with the one recently finished on Beaver Brook, will hold fully one hundred and thirty days' supply (as determined by the least yield of a collecting ground of five square miles) and which, therefore, are of sufficient capacity to equalize and render available the entire flow of the year of extreme drought. The capacities of the basins I have roughly calculated from the areas determined by the surveys of your engineer, and from an assumed depth, which I suppose to be rather less than the depth that may actually be secured.

The three basins, as you have already proposed, can be connected by pipes, and thus be made to practically act as one. There are no serious obstacles to overcome in laying the pipes. One deep rock cutting of about one thousand feet in length would be encountered, but this is in no way formidable. In short, the whole work would be of a remarkably simple and inexpensive character, much more so than would be anticipated when the broken and rocky nature of the ground is considered.

The water from this drainage area, as it flows in the streams, appears to be very pure, and at the time I saw it was clear and bright, and apparently was, in all respects, in a fit condition to be delivered directly to the city. It is liable, I suppose, to the discoloration from vegetable matter—such as is taken up from leaves and grasses, etc.—which is found in the river and brook waters of this part of the country almost without exception, especially in the late summer and fall, but by subsidence and exposure to the air in

# Practicability of the Plan

FOR

# INCREASING THE WATER SUPPLY.

---

The Public Water Board having had occasion, during the presen
season, to consult, professionally, Mr. Joseph P. Davis, Enginee
in Chief of the Cochituate Water Works, Boston, they invit
that gentleman to consider the plan of increasing the water supp
of the city, recommended to the City Council by the Board in th
report herewith submitted. His opinion of the practicabilit
the plan presented, and of the value [illegible] streams at N
Saugus as additional sources of supply [illegible] found in the
joined letter:

[illegible], April 2, 1

*To the President of Public Water Boa*

DEAR SIR:—During a recent visit [illegible]
is proposed to take a supply of water [illegible]
works, you requested me to give, in wr
to the feasibility of constructing works
age of the water, and of the charac
be collected. In response to that requ

The surface of the drainage area i
of earth underlaid by rock, and cons
collect and deliver up a very high
your experience with the collecti
proved. I should judge that

storage basins it would lose any color it might acquire from this cause.

In the first use of the newly formed basins, and until the vegetation on the area overflowed is chiefly decomposed, some discoloration of the water will probably be noticed, and a slightly bitter or marshy taste may be found, but these will gradually disappear, and even at first will hardly be discovered except by the observant consumer. By thoroughly grubbing the flowage area, and removing the deposit of muck where the depth of water will be but a few feet, the color and taste may, in a great measure, be avoided. These vegetable impurities are harmless, in a sanitary point of view ; the *dangerous* impurities to which waters for a domestic supply in Eastern Massachusetts are liable, are of animal origin.

There is, perhaps, remote danger in the use of water from all sources that have been contaminated with sewage matter and refuse, even in a limited degree, and in the case of sources where the daily flow of water is not large, this danger is to be feared, and guarded against. Usually it is not possible to avoid all sewage, but it is of the utmost importance that it be of very limited amount compared with the volume of water with which it mingles, great dilution being necessary to neutralize its dangerous qualities. It is also very desirable that the water should have either a long run or several days of subsidence in basins before it is delivered to consumers.

The area from which you propose to draw your supply is now almost absolutely free from anything which will cause contamination of animal origin, and from its broken, rocky, and barren nature, it appears likely to remain so in the future. It contains hardly any population, offers no encouragement for the location of manufactories within it, and is almost too poor for pasturage even.

In conclusion, I consider that the area from which you propose to obtain your additional supply, presents good opportunities for building the necessary works, and is very favorable for the purity of the water.

Respectfully yours,

JOS. P. DAVIS.

# LYNN WATER WORKS.

# REPORTS

ON THE

# TRIAL OF DUTY AND CAPACITY

OF THE

# PUMPING ENGINE.

December, 1873.

Evening Post Steam Presses, 41 Nassau St., cor. Liberty.

# FIRST REPORT

OF THE

# BOARD OF ENGINEERS,

ON THE

## TEST TRIAL OF THE PUMPING ENGINE AT LYNN, MASS.

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To Messrs. Edwin Walden, Jacob M. Lewis, James
Purinton, William D. Pool, David H. Sweetser,
Public Water Board of Lynn:

*Gentlemen*:—

Agreeably to your request, we have made a test trial of the pumping engine connected with your works, and now respectfully present this our first report.

The character of the engine being entirely different from that prescribed in the original specifications, it seemed to us that the manner of conducting the experiment, and of determining the capacity and duty of the engine, was left without restriction to our judgment, and in this view your chairman concurred.

As the pumping engine at Lowell is very similar to yours in construction and performance, we have followed the modes of test that were adopted at the late trial there.

The engine was started at 8:50 A.M., December 10, 1873. but the test was not considered to have commenced till 11 A.M., and it was concluded at 3 P.M., December 12, making the duration of the trial fifty-two hours, without stop. The engine at the conclusion of the test continued its work, the fires and water in the boilers being kept as uniform as possible, and the duration of the experiment was established by inspection of the firing as shown on the coal profile plot. The capacity of the pump was determined by weir measures at the reservoir—three hours, from 3 P.M. to 6 P.M., December 10, and three hours, from 3 P.M. to 6 P.M., December 11—and the actual delivery was found to be ninety-six per cent. of the capacity as given us by Mr. Leavitt, the mechanical engineer who designed the machine. The capacity of the full pump is 194.37 gallons; the delivery per revolution, as determined by weir measurement, was 186.55 gallons; the number of revolutions made in the fifty-two hours was 57,357; and the total quantity of water delivered at the reservoir during that time, 10,700,163 gallons—or the delivery was at the rate of 205,772 gallons per hour. The delivery required by the terms of the contract is 200,000 gallons per hour.

The duty was established as follows:—The area of the pump, by our measures of the diameter, is 534.53 square inches.

| | |
|---|---|
| The load was determined from a gauge on the main, near the pump, the average reading of which was | 64.20 lbs. |
| The difference of level between centre of gauge and surface of water in the pump-well, reduced to pounds | 8.21 lbs. |
| Allowance for friction and bends of main, between gauge and pump-well, as at Lowell | 1.00 lbs. |
| Total pressure per square inch | 73.41 lbs |

The length of stroke, as measured, was seven feet.

From the above data, and the number of revolutions, the work done at the pump was determined, no deduction having been made for loss of action. The coal was picked Lackawanna coal, and the contractor was allowed to make use of any coal from the cinder that he deemed of value as combustible, but no credit has been allowed for screenings or unconsumed coal. The coal has been charged against the machine in gross, and the total quantity fed into the furnaces during the fifty-two hours was 15,160 pounds. The division of the pounds-feet of work by the weight of coal determined the duty, and the result is 103,923,215 pounds-feet for every one hundred pounds of coal fed into the furnaces.

The duty given by your engine is, so far as we are aware, the highest that has ever been obtained by trial test of any pumping engine in this country, and we believe that in the future it will make a good record for itself—a record that will confirm the wisdom of your action in adopting so novel a form of machine. The arrangement of parts, though unusual, appears judicious, and to have been well considered. The framing is particularly worthy of mention, as showing a distribution of material favorable for strength and rigidity.

WM. E. WORTHEN,
J. C. HOADLEY,
JAMES P. KIRKWOOD,
CHAS. HERMANY,
JOS. P. DAVIS.

Boston, Dec. 13, 1873.

# SECOND REPORT

OF THE

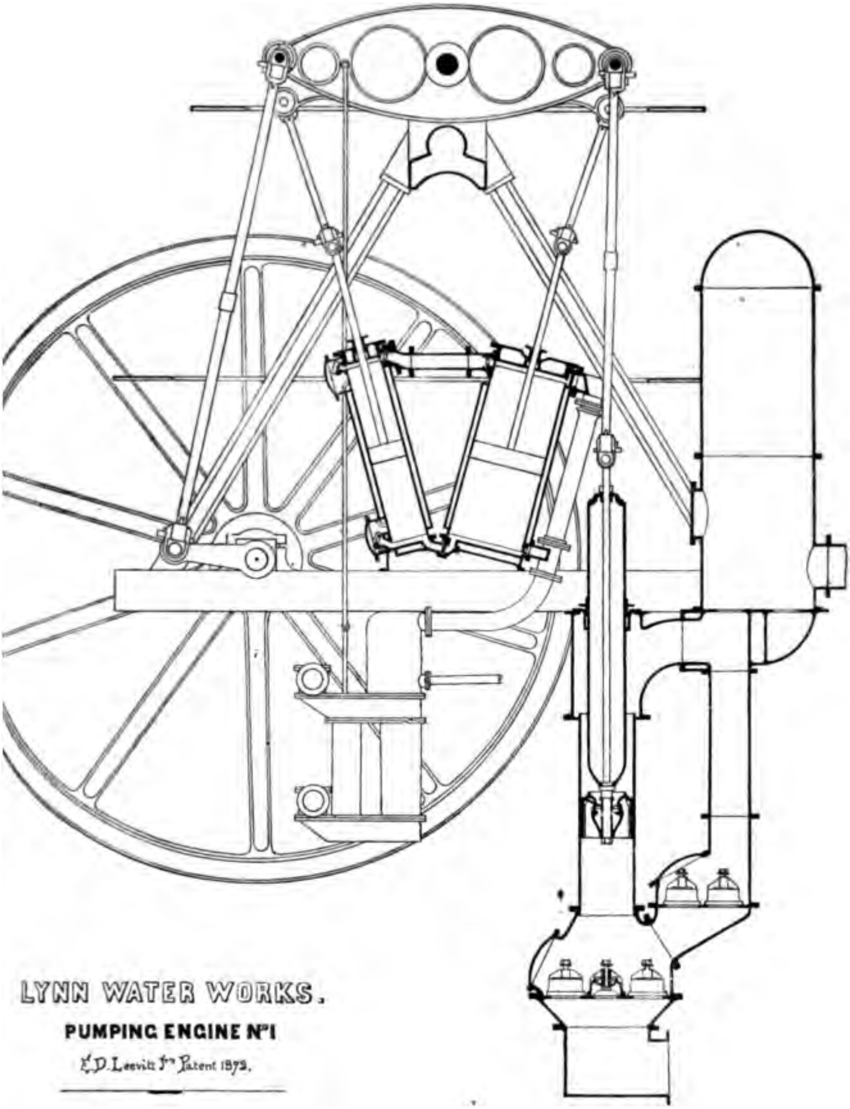
# BOARD OF ENGINEERS,

ON THE

## TEST TRIAL OF THE PUMPING ENGINE, TO THE PUBLIC WATER BOARD OF LYNN, MASS.

*Gentlemen:*—

The object in presenting our First Report, of December 13, 1873, immediately after the conclusion of the test trial, was to enable your Board to make a settlement with the contractor for the engine. It was of primary importance, therefore, to give the results of the experiments, the capacity and duty of the pumping-engine, requirements of the contract, rather than any description of the engine, or the manner of conducting the test; but it seemed that something more than this brief report was due to ourselves and the engineering profession, and that a full record should be published, descriptive of the design and arrangement of the engine, the manner of conducting the experiments, and the data obtained, to enable any one conversant with such matters, not only to criticise our modes of test, and our conclusions, as given in the former report, but also to afford valuable information for future constructions and investigations. Subsequent revision of our data has not led us to change our previous conclusions, and what we propose now is to give what may be considered a narrative of the trial, a preservable copy, for our own use, and that of the profession especially, of our records and observations, with descriptions and drawings of the engine and its connections.



LYNN WATER WORKS.

PUMPING ENGINE N$^{o}$1

E. D. Leavitt J$^{r}$ Patent 1873.

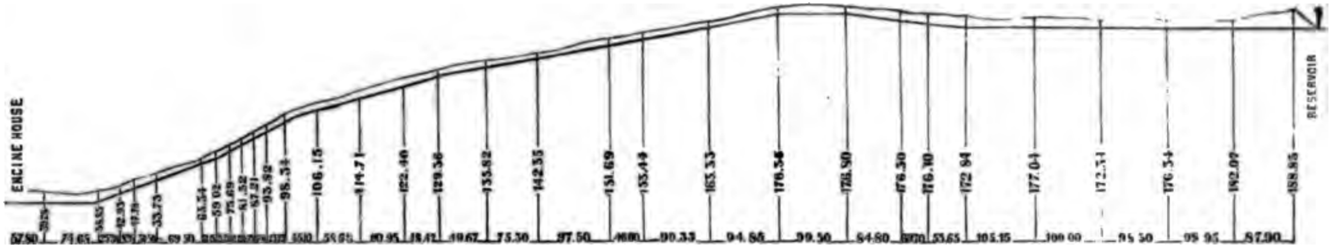
The pumping machinery, complete, was furnished and erected under a contract with Mr. George H. Norman, of Newport, R. I. The engine, compound cylinders, with beam-crank and fly-wheel, was designed by Mr. E. D. Leavitt, Jr., of Cambridgeport, Mass., and built by Messrs. I. P. Morris & Co., of Philadelphia, Pa. There are many novel features in the machine, which have been patented by the designer, the most noticeable of which, as shown in the cut, is the arrangement of the steam cylinders, which are located under the beam centre and incline outwardly, so that their pistons are connected to the opposite ends of the beam, and move in opposite directions. The top of the high-pressure cylinder exhausts, therefore, into the top of the low-pressure cylinder, and the bottom of the high-pressure cylinder into the bottom of the low-pressure cylinder. By this arrangement the passages between the two cylinders are made very short and direct. A single valve controls the connection between the two cylinders at the bottom, whilst two valves are used in the connection at the top, one close to each cylinder, so that the capacity of this passage is not added to the clearance of the high-pressure cylinder when being filled with steam, nor is it exhausted when the low-pressure cylinder is being exhausted. All the steam valves are gridiron slides. The high-pressure valves have a cam cut-off, controlled by a governor, readily adjustable to variable speeds. All the other valves are worked by positive cams. The cams are all of large radii, so that the opening and closing of the valves are almost instantaneous. Both cylinders are steam-jacketed at sides and ends, and, together with the steam connections, are clothed with asbestos covering and lagged with black walnut.

The air-pump is double-acting, and worked by a connection with the beam. The discharge from the hot-well is into the pump-well, and the boiler feed-water is drawn from the hot-well by an independent donkey steam-pump.

The pump is of the Thames-Ditton variety, bucket and plunger-pump. There is a supplementary pipe and valves to reduce the friction incident to the passage of the water through a single bucket valve in the piston. The valves are of the usual double beat form; the bottom, or foot valves, are seven in number, the upper valves three—one in the piston and two in the supplementary passage; each of the exterior bottom valves has an independent cover on the chamber, for the readier inspection and removal of the valves. To supply air to the air chamber, there is a small air-cock on the lower valve chamber. The air drawn in through this cock on the up-stroke of the pump somewhat reduces the quantity of water discharged by the pump. Careful experiments, previous to and in the early part of the test, established the effect of this cock, by measurements at the weir, and an uniform opening of this cock was kept during forty-eight hours of the trial. During the other four hours the average loss of action was a trifle less than during the forty-eight hours, during one hour the cock being completely closed.

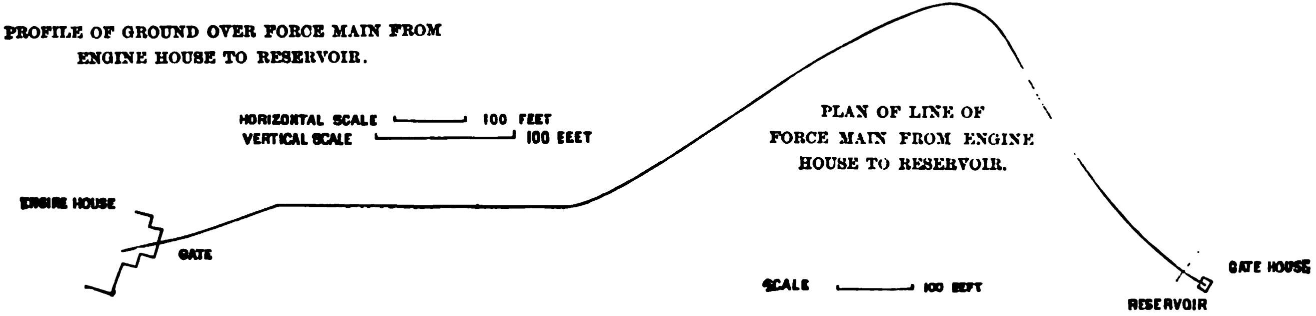
*Boilers.*—The boilers are two plain horizontal tubulars, set in brick-work, fired beneath, flame passing the length of the boiler and returning through the tubes to a front connection, thence passing up into a single flue on the top of the boilers in brick-work, and to the chimney. There was no clothing at the front end of the boilers. There were automatic dampers attached to the boilers, but during the experiments they were disconnected and worked by hand.

*Mains.*—The water is drawn by the pump from a large well, supplied by a main from the collecting pond, and discharged through a twenty-inch force main. This main is of cast-iron to the point marked gate in the cut, thence by cement-lined sheet-iron pipe of the same diameter, to the bottom of the gate-house in the service reservoir, and thence by a vertical cast-iron pipe of sufficient height to discharge into a wooden trunk, connected with a weir box, where the capacity of the pump was determined. No record has been preserved of the exact position, the lines both in the horizontal and plans given in the cut, are from recent surveys, made since the trial, on the surface of the ground, and are probably very nearly approximative. On the main, there are two gates and one check valve.



PROFILE OF GROUND OVER FORCE MAIN FROM ENGINE HOUSE TO RESERVOIR.

HORIZONTAL SCALE 100 FEET
VERTICAL SCALE 100 EEET



PLAN OF LINE OF FORCE MAIN FROM ENGINE HOUSE TO RESERVOIR.

SCALE 100 FEFT

## TABLE OF DIMENSIONS.

| | | |
|---|---|---|
| Diameter of high-pressure cylinder | 17½ | inches. |
| " low- " " | 36 | " |
| " high- " " piston rods | 3 | " |
| " low- " " piston rods | 3¾ | " |
| " air pump | 11¼ | " |
| " pump-barrel | 26 1/10 | " |
| " plunger | 18½ | " |
| " bottom and supplementary valves outside lower seat | 15⅞ | " |
| " " " " " inside upper " | 10 | " |
| " piston valve, outside lower seat | 22 | " |
| " " " inside upper " | 16½ | " |
| " of fly-wheel | 26½ | feet. |
| Length of stroke of steam and water pistons | 7 | " |
| " " air-pump | 49½ | inches. |
| Distance between end centres of beam | 14 | feet. |
| Steam lead, high-pressure cylinder, top | 0 | " |
| " " " " bottom | 0 | " |
| " " low- " " top | 0 | " |
| " " " " bottom | 1/16 | inch. |
| Exhaust lead, high-pressure " top | 1/16 | " |
| " " " bottom | 1/16 | " |
| " low- " " top | 5 3/16 | inches. |
| " " " bottom | 3 | " |
| Closure before end of stroke : | | |
| High-pressure cylinder, top | 9⅞ | " |
| " " bottom | 14 11/16 | " |
| Low-pressure " top | 6 | " |
| " " bottom | 5 5/16 | " |
| CLEARANCES : | | |
| High-pressure cylinder, top | .0231 | of vol. of cylinder. |
| " " bottom | .0360 | " " |
| Low- " " top | .0109 | " " |
| " " bottom | .0104 | " " |
| Top connection between cylinders | .0834 | of high-press. " |
| Weight of fly-wheel | 24,000 | pounds. |
| " walking beam | 9,500 | " |
| " moving parts connected with beam | 11,000 | " |
| BOILERS : | | |
| Diameter of shell | 5 | feet. |
| " drum | 3 | " |
| " tubes | 3 | inches. |
| Length of shell | 16 | feet. |
| Height of drum | 6 | " |
| Length of grate | 5 | " |
| Width of grate | 5 feet 6 | inches. |
| FORCE MAIN : | | |
| Length of force main from pump to top of vertical pipe at reservoir | 1,904 | feet. |
| Height of top of vertical pipe above bottom of well | 163 34 | " |

## RECORDS OF THE TRIAL.

During the continuance of the test, one of the subscribing engineers was always on duty at the engine-house, often two, and sometimes four. The measures of the weir were taken by two members of the board, and the heights of the water over the weir were checked by them. Gauges and scale were carefully tested, and every provision was made to secure accuracy of observation and record. Mr. Hoadley, of our board, was, during the whole trial, on committee business at the State House, but had previously arranged with us the mode of conducting the experiment; had made a preliminary test with us, and was represented during this by his assistant, Mr. Huntoon.

Two watches of assistants were detailed, one for the engine-room, the other for the boiler-room, but were relieved in portion of their duties, from time to time, by the experts. Other assistants were employed in recording the heights of the water over the weir, and in dividing and measuring the indicator cards as taken from the steam cylinders and pump.

The duties of the assistants in the engine room, were to take indicator cards from each end of both cylinders hourly, to make observations, and records as follows:

## RECORDS OF THE ENGINE ROOM.

| Date. | Time. | Counter. | Pressures. |  |  |  | Temperatures—Degrees Fahrenheit. |  |  |  |  | Depth of water in well, | Feed Water. |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | Steam, lbs. | Vacuum, inches. | Water, lbs. | Barometer, inches. | Steam. | Hot well. | Pump well. | Feed water. | Outside air. | ft. in. | Cask No. 1. casks. | Cask No. 2. lbs. | Total lbs. |
| December 10 ......... | 11 a. m. | 242,646 | 75½ | 27¾ | 63 | 30.14 | 325 | 98 | 40 | 91 | 37 | 8.1¼ | 3 | 850 | 200 |
| December 12.. ..... .. | 3 p. m. | 300,003 | 75¾ | 28 | 63½ | 29.68 | 324 | 91½ | 41 | 96 | 38 | 8.1 | 373 | 310 | 130,240 |

The indicators were Richards' patent and Elliot & Co.'s make. They were carefully tested before the trial; and at about the middle of the trial the indicators on each cylinder were changed from one end to the other of the cylinder, so that half of the cards at the top and half at the bottom are taken by different indicators. The springs used in the high-pressure cylinder indicators were 32 lbs. to the inch; in the low, 16 lbs. to the inch. All the hourly cards taken from 9 A. M., December 10, to 3 P. M., December 12, have been divided, measured, and re-measured, and will be found tabulated toward the end of this report.

It has not been considered necessary to publish the records of the engine room in full. The hourly readings of the counter, and the total quantity of water fed to the boiler will be thus given. Of the records of the other columns, the extreme readings and averages have been deemed sufficient.

The steam, vacuum and water gauges were attached to the engine frame, and connected as directly as possible with the steam-pipe, condenser and air chamber. At the conclusion of the trial, the steam gauge was tested and its reading was found to be 5 lbs. in excess, at the average of 75½ lbs.. and should, therefore, be 70½ lbs. The vacuum gauge was not tested. As the estimate of duty was dependent on the reading of the water gauge this was carefully tested before and after the trial. Its reading at the average of 63.60 lbs. was found to be too small by 0.6 lbs., and should be therefore 64.20 lbs.

The barometer was an Aneroid, placed in the engine room. The records during the trial compare very nearly with the observations of the Signal Service Station at Boston. From the readings of the barometer, the zero on the indicator cards has been established, to which all pressures are referred instead of to the atmospheric line.

The temperature of the steam was taken by a Siefert thermometer, inserted into the main steam-pipe just outside the engine stop-valve.

The temperatures of the hot well were taken at its overflow into the pump-well after a passage of say 25 feet; the temperatures of the pump-well from a thermometer suspended therein; of the feed-water from the lower measuring cask; of the outside air from the front of the engine-house. The thermometers used for all the above observations were of Huddleston's make.

The depth of water in pump well was taken from a scale in the engine-room, connected with a float in the well. The average reading was compared by ourselves with a B. M. on the wall, which had been referred to the top of the vertical pipe in the reservoir by one of Mr. Davis' assistants.

*Feed-Water.*—The quantity of water fed into the boilers wasdetermined by an arrangement of casks of measured capacity. An upper cask (No. 1), which could be filled directly from the hot well and discharged into the lower cask (No. 2), which last was connected with a Blake donkey-pump, and was discharged into the boilers. Into cask No. 1, 350 lbs. of water, at 100° Fahrenheit, were weighed and discharged, and at the level of the surface of the water an overflow was cut, so that the capacity of this cask was established at 350 lbs. of water. Outside of cask No. 2, a glass boiler-gauge was placed, connected with the bottom and top of the cask; and beside this gauge was a scale marked accurately to every 100 lbs. of water at 100° Fahrenheit, as it was weighed consecutively and poured into the cask. The working of this arrangement of casks is as follows: An assistant, exclusively in charge, closes the connection between the casks; fills No. 1 from the hot well, closes the connection between the hot well and opens that between the casks, and so continues filling into No. 1 and emptying into No. 2 as fast as drawn out by the feed pump, holding always some balance in the lower cask, and keeping tally of the total number of upper casks filled and emptied. At each hour the engine-room assistant receives the tally of cask No. 1, and notes by the scale on the glass gauge the quantity remaining in cask No. 2. From the tally, he knows how much water has been drawn from the hot well, and from his observation how much of this water still remains to be fed into the boilers.

Thus, at 11 A. M., December 10, three casks No. 1 had been filled and discharged into cask No. 2, and 850 lbs. still remained in the latter.

3 × 350 — 850 = 200 lbs. fed into the boilers.

At 3 P. M., December 12, 373 casks No. 1 had been filled and discharged into No. 2, and 310 lbs. remained in the latter.

373 × 350 — 310 = 130,240 lbs. fed into the boiler.

130,240 — 200 = 130,040 lbs. fed into the boilers between the hours of 11 A. M., December 10, and 3 P. M., December 12.

## RECORDS OF THE BOILER-ROOM.

The coal used was egg and broken Lackawanna, of good average quality, as found in one of the Lynn coal yards. As no allowance was to be made for cinder or unconsumed coal, and as it was consistent with the method at the late trial of the pumping-engine at Lowell, the contractor was permitted to cull or pick the coal, that as little incombustible material as possible might be charged to the boilers. Between the hours of 9:20 A. M. and 11:40 A. M., December 12, 149 lbs. were selected by the contractor from the screenings and fed into the grates. At the close of the trial there were 474 lbs. of cinders, 336 lbs. screened coal, and 355 lbs. of very fine coal from the grates. No account of any of the above quantities have been taken in our estimates of duty or of evaporation. The facts are only noted for comparison with other experiments in which evaporation has been predicated on combustible material.

The engine had been started on the afternoon of December 9 and run till 1:30 A. M., December 10. It was started again at 8:50 A. M., and some observations were taken at 9 and 10 A.M., but it was not till 11 A. M. that the trial commenced. At that time the fires beneath the boilers were in good working condition. The water in the boilers was at an established height, and the engine was making the number of revolutions which were found by the weir to give a discharge a little in excess of the capacity contrated for. These conditions were kept as nearly uniform as possible during the whole time of the trial, and when at 3 P.M., December 12, the test trial closed, the engine was still running at the same speed, and the fires continued to be kept in the same working conditions, whilst we made experiments on the quantity of water condensed in the steam jackets.

Two assistants, on alternate watches of about twelve hours each, had charge of the boiler-room observations, and had constant supervision, except when relieved by ourselves or other assistants at meals. The form of record is as follows:

## RECORD OF BOILER ROOM.

| Date. | Time | Gross weight, lbs. | Seperate weight. | Grate Charges. |  | Total. | Pressure. |  | Water, Inches. |  | Temperature, ° Fahrenheit. |  | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  | Boiler No. 1. | Boiler No. 2. |  | No. 1. | No. 2. | No. 1. | No. 2. | Feed. | Flue. |  |
| December 11 | 9.20 A. M. | 500 |  |  |  | 10,500 |  |  |  |  |  |  |  |
| " | .35 |  | 460 |  | 40 | 10,540 |  |  |  |  |  |  | 9.30 to 10.30. Used steam from main boiler for donkey feed. |
| " | .45 |  | 310 | 150 |  | 10,690 |  |  |  |  |  |  |  |
| " | 10.00 |  |  |  |  | 10,752 | 76 | 77 | ¾ | ¾ | 98 | 334 |  |
| " | .20 |  | 160 |  | 150 | 10,840 |  |  |  |  |  |  |  |
| " | .45 |  |  | 160 |  | 11,000 |  |  |  |  |  |  |  |
| " |  | 500 |  |  |  |  |  |  |  |  |  |  |  |
| " | 11.00 |  |  |  |  | 11,064 | 78 |  | 1¼ | 1¼ | 96 | 335 |  |
| " | .20 |  | 350 |  | 150 | 11,150 |  |  |  |  |  |  | 11.35; cleaned fire boiler No. 1. |
| " | .45 |  | 180 | 170 |  | 11,320 |  |  |  |  |  |  |  |

Of the above recorded observations, only the average level of the water in the two boilers, and the totals of the coal fed upon the grates hourly will be given in full towards the end of this report.

The coal was weighed in lots of 500 lbs. each in a permanent box on the scales, and left there to be drawn from according to the necessities of the fires. As each 500 lbs. was weighed it was set down in the col. of gross weights.

In the column Separate Weights is set down the balance left in the box after each firing, and the quantity taken from the box is set down under Grate Charges to boiler No. 1 or No. 2 where it was fired, but under the column Total Coal, is set down the amount of coal used in both boilers; thus, at 9:20 A. M., December 11, 500 lbs. were weighed and 10,500 had been previously weighed and fired. At 9:35 A. M., coal was fired on No. 2 grate, and 460 lbs. were left in the box. 500—460=40 lbs. was charged to No. 2, and the total was increased to 10,540. At 9:45 A. M., coal was fired on No. 1 grate, leaving 310 lbs. in the box. 460—310=150 lbs. was charged to No. 1, and the total was increased to 10,690 lbs. These quantities of coal and times of firing have been plotted on cross section papers, the ordinate divisions representing a scale of lbs. and the abcissa divisions one of hours. From an inspection of the profile thus constructed, the character of the firing may be readily understood. The absolute total fired at each hour may be interpolated, or the relative total properly chargeable at the time, reference being had to the character of firing as shown previous to and after; whether it was light or heavy beyond an average grade line, that is, whether the fireman had been depreciating the character of the fire or improving it. The firing record was commenced before 11 A. M., December 10, and there was no coal fired between 2:45 and 3 P. M., December 12; and the quantities fired at 11 A. M. and 3 P. M. have been established from the grade line on the profile. With these exceptions, the total coal fired at each hour and hereafter given are the quantities interpolated by proportion between the two firings nearest the hour.

The pressures on the gauges of each boiler were observed and noted hourly. On comparison of these gauges with the standard, the reading of gauge, boiler No. 1, was found to be, excess, 2.5 lbs., and of boiler No. 2, 3 lbs. At the average reading, thus, No. 1 reading 76 lbs., should be 73.5 lbs., and No. 2, reading 77 lbs., should be 74 lbs.

Scales graduated to inches were placed against the glass water-gauges of each boiler, the zero being assumed at the height of one foot above the centres of the boilers, and the levels of the water in each boiler above or below the zero were noticed hourly.

The temperature of the feed water was taken from a Siefert thermometer inserted into the feed connection between the donkey-pump and the boiler.

A plugged pipe, filled with oil, was suspended in the main flue, at the top of the boilers, and the temperature of the flue was taken by inserting a Siefert thermometer into the oil.

It will be observed under column Remarks, "9:20 to 10:30. used steam from main boiler for feed." The engine has no pump connected directly with it as at Lowell, and it has been usual to drive the donkey-pump directly from the boilers, but for the purposes of this trial it was thought best to drive the donkey by an independent boiler. Unfortunately, at times during the trial, the steam got too low in this boiler, and steam had to be drawn from the main boilers. Each time this occurred was noted, and the aggregate was found to be 8 hours out of the 52 of the trial. By experiments of Messrs. Copeland & Worthen, on the trial of Ridgewood Engine No. 3, December, 1869, it was found that one per cent. of the steam raised for the driving of the engine was used by the donkey. Adopting this basis for the 8 hours, it will be found that during this time as much steam would have been used by the donkey as would have been for the driving of a pump 52 hours, connected as at Lowell with the engine.

## MEASURES OF CAPACITY OF PUMP.

The overflow from the stand-pipe at the reservoir was conveyed by a wooden trunk into a weir box 15 feet long, 6 feet wide and 4 feet 6 inches deep. The weir was at the opposite extremity from the trunk. Its crest was 2.11$\frac{3}{4}$ above the bottom of the box, and 3.73 feet wide, and placed centrally in the end of the box. That the water should approach the weir with as uniform flow as possible, two racks covered with wire cloth were placed between the trunk and the weir. The arrangement of weir and mode of taking heights of water were like those adopted by Mr. Francis in his "Lowell Hydraulic Experiments.' The readings were every 2½ minutes, and as the heights varied but little they have been averaged as giving a result sufficiently near. The discharges have been calculated by Mr. Francis' Tables and the correction for velocity of approach from his formula.

The readings were taken from 3 P.M. to 6 P.M., December 10, and from 3 P.M. to 6 P.M., December 11. Readings would have been taken the 12, but the filling of the reservoir by the pumping disturbed the supports of the weir box.

| | | | |
|---|---|---|---|
| The average height on the 10th was | 0.743 | | |
| " " " 11th " | 0.739 | | |
| Discharge from 3 P.M. to 6 P.M., December 10th | 7.666 cubic feet per second. | | |
| " " " " " 11th | 7.606 " " " | | |
| Leak of weir measured and estimated | .0092 " " " | | |
| Revolutions of engine during 3 hours, from 3 P.M. to 6 P.M., Dec. 10th, | 3,303. | | |
| " " " " " " " 11th, | 3,314. | | |
| Capacity of pump by weir, measured December 10th | | 187.49 | galls. |
| " " " " " 11th | | 185.41 | " |
| Average | 185.45 | | " |
| Add for leak at weir | .23 | 186.68 | " |
| Measured capacity | | 194.37 | " |

$$\frac{194.37}{186.68} = .9601.$$

Loss of action of pump as given in the first report, 4 per cent.

# INDICATOR-CARDS, PUMPING

**TABLE**

HIGH PRES

| Date. | Time. | Forward Stroke. | | Back Stroke. | | At 0.05 | | At 0.15. | | At 0.25. | | At 0.35. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Initial. | Final. | Initial. | Final. | | Subtractive. | | Subtractive. | | Subtractive. | | Subtractive. |
| | | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. |
| Dec. 10.. | 9 A.M. | 87.2 | 28.2 | 25.7 | 50.0 | 87.2 | 22.7 | 87.2 | 8.2 | 87.2 | 8.7 | 72.0 | 9.7 |
| " | 10 " | 86.0 | 29.0 | 23.0 | 50.0 | 86.1 | 20.2 | 86.0 | 8.5 | 86.0 | 8.7 | 74.2 | 9.2 |
| " | 11 " | 84.5 | 31.0 | 26.5 | 52.0 | 84.0 | 24.0 | 83.7 | 9.0 | 83.7 | 9.2 | 83.7 | 10.2 |
| " | 12 M. | 84.5 | 23.0 | 26.0 | 50.5 | 84.5 | 23.5 | 84.5 | 8.7 | 84.5 | 9.0 | 82.5 | 10.0 |
| " | 1 P.M. | 85.0 | 29.8 | 25.0 | 51.0 | 85.0 | 23.7 | 85.0 | 9.0 | 85.0 | 9.0 | 81.5 | 10.0 |
| " | 2 " | 83.5 | 29.5 | 25.0 | 51.0 | 83.5 | 24.0 | 83.5 | 8.9 | 82.5 | 9.0 | 82.5 | 10.0 |
| " | 3 " | 84.5 | 29.5 | 25.0 | 49.6 | 84.5 | 20.0 | 84.5 | 8.8 | 84.2 | 9.0 | 80.0 | 10.0 |
| " | 4 " | 84.7 | 29.2 | 25.6 | 50.7 | 84.2 | 23.7 | 84.2 | 8.5 | 83.8 | 9.0 | 76.5 | 10.0 |
| " | 5 " | 84.0 | 30.0 | 24.9 | 50.7 | 84.0 | 23.7 | 84.0 | 8.2 | 84.0 | 9.0 | 72.5 | 10.0 |
| " | 6 " | 85.2 | 30.1 | 25.5 | 50.7 | 85.0 | 23.5 | 85.0 | 8.5 | 85.0 | 9.0 | 84.9 | 9.5 |
| " | 7 " | 83.0 | 29.7 | 26.0 | 50.7 | 82.3 | 23.5 | 82.2 | 8.7 | 82.2 | 9.7 | 76.2 | 10.6 |
| " | 8 " | 85.2 | 29.0 | 25.0 | 49.7 | 85.0 | 22.0 | 85.0 | 8.0 | 85.0 | 8.5 | 78.0 | 9.2 |
| " | 9 " | 86.0 | 30.2 | 25.6 | 51.0 | 85.0 | 23.0 | 84.9 | 9.2 | 84.5 | 9.0 | 80.0 | 9.5 |
| " | 10 " | 84.7 | 29.7 | 25.0 | 49.5 | 84.5 | 21.5 | 84.5 | 8.0 | 84.5 | 8.5 | 80.0 | 9.2 |
| " | 11 " | 84.2 | 30.5 | 25.7 | 50.0 | 84.0 | 22.5 | 84.0 | 8.5 | 83.0 | 9.0 | 81.0 | 9.9 |
| " | 12 M.N. | 83.0 | 30.5 | 26.0 | 50.8 | 81.7 | 22.5 | 81.5 | 8.0 | 81.3 | 8.6 | 81.1 | 9.5 |
| Dec. 11.. | 1 A.M. | 86.0 | 30.5 | 26.0 | 51.7 | 85.5 | 23.7 | 85.2 | 8.7 | 85.2 | 8.7 | 81.0 | 9.7 |
| " | 2 " | 81.0 | 31.5 | 27.0 | 51.5 | 80.7 | 24.0 | 80.2 | 9.0 | 80.0 | 9.0 | 79.6 | 9.0 |
| " | 3 " | 84.7 | 31.0 | 26.0 | 51.0 | 84.7 | 23.5 | 84.6 | 8.5 | 84.5 | 9.0 | 83.0 | 10.0 |
| " | 4 " | 83.5 | 31.0 | 26.0 | 51.2 | 83.0 | 23.0 | 83.0 | 8.7 | 83.0 | 9.0 | 80.5 | 9.5 |
| " | 5 " | 85.2 | 30.7 | 25.0 | 52.2 | 84.7 | 24.5 | 84.7 | 8.5 | 84.1 | 9.0 | 81.0 | 10.0 |
| " | 6 " | 84.7 | 30.5 | 26.0 | 51.2 | 84.5 | 24.0 | 84.5 | 8.5 | 84.5 | 9.0 | 82.5 | 9.7 |
| " | 7 " | 87.0 | 31.2 | 25.2 | 51.0 | 85.5 | 23.0 | 85.2 | 8.5 | 85.2 | 8.7 | 82.0 | 9.5 |
| " | 8 " | 87.0 | 29.5 | 25.6 | 52.7 | 86.0 | 23.0 | 86.0 | 8.5 | 86.0 | 8.7 | 77.5 | 9.5 |
| " | 9 " | 84.5 | 30.1 | 26.0 | 49.5 | 84.0 | 23.0 | 83.2 | 8.5 | 83.0 | 9.0 | 81.0 | 9.7 |
| " | 10 " | 84.0 | 29.9 | 26.5 | 49.5 | 84.0 | 22.2 | 83.9 | 8.0 | 83.9 | 9.0 | 81.0 | 9.7 |
| " | 11 " | 84.0 | 29.0 | 25.6 | 50.0 | 83.9 | 22.0 | 83.9 | 8.2 | 83.9 | 8.7 | 79.0 | 9.5 |
| " | 12 M. | 84.2 | 29.7 | 26.0 | 51.0 | 84.2 | 24.2 | 84.2 | 8.7 | 84.2 | 8.7 | 80.7 | 9.7 |
| " | 1 P.M. | 86.7 | 30.7 | 26.2 | 50.0 | 86.5 | 22.5 | 86.5 | 8.5 | 86.0 | 9.0 | 82.0 | 9.7 |
| " | 2 " | 86.0 | 31.5 | 27.2 | 51.0 | 85.5 | 22.0 | 85.2 | 9.0 | 85.0 | 9.4 | 83.0 | 10.0 |
| " | 3 " | 88.0 | 31.7 | 26.3 | 51.2 | 87.5 | 23.5 | 87.0 | 9.5 | 86.5 | 10.0 | 84.0 | 11.0 |
| " | 4 " | 88.0 | 31.5 | 26.9 | 51.0 | 87.0 | 23.5 | 86.5 | 9.0 | 86.0 | 9.5 | 82.0 | 10.2 |
| " | 5 " | 85.0 | 31.5 | 27.0 | 52.0 | 84.5 | 22.5 | 84.3 | 9.0 | 84.0 | 9.5 | 83.6 | 10.2 |
| " | 6 " | 86.0 | 31 5 | 26.5 | 51.0 | 85.5 | 23.0 | 85.0 | 9.0 | 85.0 | 9.5 | 83.5 | 10.2 |
| " | 7 " | 88.0 | 31.0 | 26.0 | 52.5 | 86.6 | 23.5 | 86.0 | 8.7 | 85.6 | 9.5 | 83.0 | 10.0 |
| " | 8 " | 88.0 | 31.2 | 26.5 | 52.0 | 87.2 | 24.0 | 87.0 | 8.5 | 86.6 | 9.0 | 83.2 | 10.0 |
| " | 9 " | 87.5 | 32.0 | 26.8 | 53.0 | 87.0 | 24.5 | 86.5 | 9.0 | 85.8 | 8.9 | 83.2 | 10.0 |
| " | 10 " | 86.3 | 32.0 | 27.0 | 51.5 | 85.0 | 23.0 | 84.7 | 9.0 | 84.2 | 9.5 | 83.0 | 10.0 |
| " | 11 " | 86.2 | 32.0 | 27.6 | 51.5 | 85.5 | 23.0 | 85.0 | 9.5 | 84.7 | 10.0 | 83.0 | 11.0 |
| " | 12 M.N. | 86.5 | 33.9 | 27.5 | 51.7 | 84.7 | 24.0 | 84.0 | 8.7 | 83.6 | 9.1 | 83.0 | 10.1 |
| Dec. 12.. | 1 A.M | 88.2 | 32.1 | 27.0 | 52.0 | 86.5 | 24.0 | 86.0 | 9.0 | 85.7 | 9.2 | 83.0 | 10.0 |
| " | 2 " | 86.5 | 32.7 | 27.5 | 51.7 | 84.5 | 23.0 | 84.0 | 9.0 | 83 5 | 9.2 | 83.0 | 10.2 |
| " | 3 " | 88.0 | 32.0 | 27.0 | 52.7 | 86.2 | 23.0 | 86.0 | 9.0 | 85 5 | 9.2 | 83.0 | 10.2 |
| " | 4 " | 86.5 | 32.0 | 27.5 | 52.2 | 85.0 | 23.5 | 84.0 | 8.7 | 83.5 | 9.0 | 83.0 | 9.7 |
| " | 5 " | 88.5 | 32.0 | 27.0 | 52.7 | 87.5 | 23.0 | 87.0 | 8.7 | 86.8 | 9.0 | 83.2 | 10.0 |
| " | 6 " | 87.6 | 32.0 | 26.8 | 52.0 | 86.8 | 23.0 | 86.0 | 9.0 | 85.8 | 9.3 | 84.0 | 10.5 |
| " | 7 " | 86.0 | 32.2 | 27.0 | 52.3 | 85.4 | 23.2 | 84.9 | 9.0 | 84.0 | 9.9 | 83.8 | 11.0 |
| " | 8 " | 85.5 | 31.5 | 27.6 | 50.0 | 85.0 | 22.0 | 85.0 | 9.0 | 84.9 | 9.2 | 83.5 | 10.0 |
| " | 9 " | 86.2 | 31.5 | 26.0 | 52.7 | 86.0 | 23.0 | 86.0 | 9.1 | 85.9 | 9.7 | 81.0 | 10.2 |
| " | 10 " | 88.0 | 31.5 | 26.2 | 54.7 | 87.0 | 23.5 | 86.5 | 8.9 | 86.0 | 9.0 | 83.2 | 10.0 |
| " | 11 " | 87.5 | 31.0 | 25.8 | 54.5 | 87.2 | 24.0 | 86.2 | 8.7 | 86.0 | 9.0 | 82.8 | 9.7 |
| " | 12 M. | 86.5 | 30.5 | 24.5 | 54.0 | 85.0 | 23.0 | 85.0 | 8.7 | 84.5 | 9.0 | 83.0 | 10.0 |
| " | 1 P.M. | 88.0 | 31.7 | 26.0 | 55.0 | 87.0 | 24.0 | 86.0 | 9.0 | 85.7 | 9.0 | 84.0 | 10 0 |
| " | 2 " | 87.5 | 31.0 | 26.0 | 53.1 | 86.5 | 23.0 | 85.5 | 9.2 | 85.0 | 9.5 | 82.2 | 10.2 |
| " | 3 " | 83.0 | 33.0 | 27.0 | 53.2 | 82.0 | 22.0 | 81.2 | 8.5 | 81.0 | 9.0 | 80.2 | 10.0 |
| Average | ......... | 85.7 | 30.7 | 26.1 | 51.5 | 85.1 | 23.1 | 84.8 | 8.7 | 84.5 | 9.1 | 81.2 | 9.9 |

## ENGINE, LYNN, MASS.

I.

SURE—TOP.

| AT 0.45. | | AT 0.55. | | AT 0.65. | | AT 0.75. | | AT 0.85. | | AT 0.95. | | NET AVERAGE. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Subtractive. | | Subtractive. | | Subtractive. | | Subtractive. | | Subtractive. | | Subtractive. | |
| 13. | 14. | 15. | 16. | 17. | 18. | 19. | 20. | 21. | 22. | 23. | 24. | 25. |
| 56.2 | 10.7 | 46.2 | 12.0 | 39.6 | 13.5 | 34.7 | 15.5 | 31.2 | 17.8 | 28.7 | 21.7 | 42.98 |
| 58.7 | 10.2 | 48.7 | 11.2 | 41.2 | 12.7 | 35.8 | 14.7 | 32.2 | 16.7 | 29.7 | 20.5 | 44.60 |
| 66.0 | 11.2 | 53.5 | 12.2 | 45.0 | 14.1 | 39.2 | 16.2 | 35.0 | 19.5 | 32.0 | 23.5 | 45.66 |
| 63.5 | 11.0 | 51.5 | 12.2 | 43.5 | 14.0 | 38.0 | 15.9 | 33.5 | 18.5 | 31.0 | 22.5 | 45.16 |
| 62.5 | 11.0 | 51.0 | 12.1 | 43.0 | 13.7 | 37.5 | 15.7 | 33.7 | 18.5 | 30.5 | 22.5 | 44 94 |
| 63.0 | 11.0 | 51.2 | 12.0 | 42.2 | 13.7 | 37.5 | 15.1 | 33.2 | 18.0 | 31.0 | 22.0 | 44.75 |
| 62.0 | 11.0 | 50.0 | 12.0 | 42.0 | 13.5 | 36.2 | 15.5 | 32.5 | 17.7 | 30.0 | 22.0 | 44.64 |
| 61.0 | 10.7 | 49.7 | 12.0 | 42.0 | 13.5 | 37.0 | 15.5 | 33.0 | 18.0 | 30.2 | 22.2 | 43.86 |
| 57.9 | 10.5 | 48.0 | 12.0 | 41.0 | 13.5 | 36.0 | 15.2 | 33.0 | 19.2 | 30.5 | 22.5 | 42.69 |
| 65.0 | 10.5 | 53.0 | 12.0 | 44.7 | 13.2 | 38.9 | 15.1 | 34.5 | 18.0 | 31.5 | 21.5 | 46.67 |
| 57.5 | 11.5 | 48.2 | 12.7 | 42.0 | 14.2 | 37.2 | 16.0 | 33.6 | 18.7 | 30.8 | 22.5 | 41.81 |
| 60.5 | 10.2 | 49.0 | 11.5 | 41.7 | 13.0 | 36.2 | 15.0 | 32.2 | 17.2 | 29.7 | 21.7 | 44.60 |
| 62.0 | 10.7 | 51.0 | 12.0 | 43.0 | 14.0 | 37.5 | 15.7 | 34.0 | 18.5 | 31.0 | 23.0 | 44.81 |
| 61.5 | 10.2 | 50.0 | 11.2 | 42.0 | 13.0 | 37.0 | 15.0 | 33.2 | 17.2 | 30.5 | 22.0 | 44.17 |
| 62.0 | 10.7 | 51.0 | 12.0 | 43.0 | 14.0 | 38.0 | 15.7 | 34.0 | 18.5 | 31.0 | 23.0 | 44.71 |
| 63.5 | 10.5 | 52.0 | 11.9 | 44.0 | 13.0 | 38.0 | 15.5 | 34.2 | 18.0 | 31.2 | 23.0 | 44.81 |
| 62.7 | 10.7 | 51.7 | 12.2 | 43.2 | 13.7 | 37.8 | 16.0 | 33.7 | 18.2 | 30.7 | 22.7 | 45.23 |
| 65.0 | 10.5 | 53.0 | 11.7 | 45.0 | 13.5 | 39.5 | 16.0 | 35.4 | 18.5 | 32.2 | 23.5 | 44.60 |
| 64.0 | 11.0 | 52.2 | 12.0 | 44.2 | 13.7 | 38.6 | 15.7 | 34.7 | 18.0 | 31.5 | 23.0 | 45.77 |
| 62.0 | 10.7 | 51.0 | 12.0 | 43.0 | 13.5 | 38.0 | 15.7 | 34.0 | 18.5 | 31.5 | 23.0 | 44.52 |
| 63.0 | 11.0 | 51.2 | 12.0 | 43.7 | 13.7 | 38.0 | 15.7 | 34.0 | 18.2 | 31.2 | 23.0 | 45.01 |
| 63.0 | 10.7 | 52.0 | 12.0 | 44.0 | 13.5 | 38.0 | 15.5 | 34.0 | 18.0 | 31.5 | 23.0 | 45.45 |
| 62.7 | 10.5 | 50.9 | 11.7 | 43.0 | 13.2 | 37.7 | 15.2 | 34.8 | 18.0 | 31.0 | 22.5 | 45.62 |
| 61.0 | 10.5 | 49.2 | 12.0 | 41.7 | 13.2 | 36.5 | 15.2 | 33.0 | 17.7 | 30.0 | 22.0 | 44.65 |
| 62.5 | 11.0 | 51.0 | 12.0 | 43.0 | 13.5 | 37.5 | 15.5 | 33.6 | 18.0 | 31.0 | 22.2 | 44.73 |
| 63.5 | 10.7 | 51.0 | 11.7 | 43.0 | 13.2 | 38.0 | 15.5 | 33.7 | 18.0 | 30.7 | 22.5 | 45.18 |
| 61.5 | 10.5 | 50.0 | 12.0 | 42.0 | 13.5 | 36.7 | 15.0 | 32.7 | 17.5 | 30.0 | 22.0 | 44.49 |
| 61.7 | 10.7 | 50.2 | 11.7 | 42.7 | 13.7 | 37.5 | 15.7 | 33.2 | 18.2 | 30.6 | 22.2 | 44.56 |
| 64.5 | 11.0 | 53.5 | 12.2 | 45.0 | 13.7 | 39.2 | 16.0 | 34.6 | 18.2 | 31.5 | 23.5 | 46.48 |
| 65.0 | 11.2 | 53.0 | 12.5 | 45.0 | 14.0 | 39.5 | 16.2 | 35.5 | 19.0 | 32.5 | 23.5 | 46.23 |
| 66.0 | 11.5 | 54.5 | 13.0 | 46.0 | 14.7 | 40.7 | 16.0 | 36.0 | 18.9 | 32.7 | 23.2 | 46.96 |
| 64.0 | 11.0 | 53.0 | 12.5 | 45.2 | 14.0 | 39.5 | 16.2 | 35.0 | 19.2 | 32.2 | 23.7 | 46.15 |
| 68.0 | 11.2 | 55.5 | 12.5 | 46.5 | 14.0 | 40.5 | 16.2 | 36.0 | 19.1 | 32.5 | 24.0 | 46.71 |
| 64.3 | 11.2 | 54.5 | 12.5 | 45.5 | 14.0 | 40.0 | 16.4 | 35.5 | 19.2 | 32.2 | 24.0 | 46.19 |
| 64.0 | 11.0 | 52.9 | 12.5 | 44.5 | 14.0 | 39.1 | 16.0 | 35.0 | 19.0 | 32.0 | 23.0 | 45.94 |
| 64.0 | 11.0 | 52.2 | 12.2 | 45.0 | 14.0 | 39.5 | 16.2 | 35.5 | 19.0 | 32.2 | 24.0 | 46.44 |
| 65.0 | 11.0 | 54.0 | 12.5 | 45.5 | 14.2 | 40.0 | 16.2 | 36.0 | 19.0 | 33.0 | 24.0 | 46.66 |
| 64.8 | 11.0 | 53.8 | 12.5 | 46.0 | 14.0 | 40.2 | 16.1 | 36.0 | 19.0 | 33.0 | 23.2 | 46.35 |
| 65.6 | 12.0 | 54.1 | 13.2 | 46.4 | 14.7 | 40.7 | 17.0 | 36.3 | 20.0 | 33.0 | 24.0 | 45.98 |
| 67.3 | 11.0 | 55.1 | 12.7 | 48.5 | 14.0 | 42.2 | 16.1 | 37.1 | 19.1 | 34.3 | 24.0 | 47.09 |
| 65.0 | 11.0 | 54.0 | 12.2 | 46.0 | 14.0 | 41.0 | 16.2 | 36.0 | 19.2 | 33.1 | 24.0 | 46.73 |
| 64.0 | 11.7 | 53.5 | 13.0 | 46.5 | 14.5 | 41.0 | 16.8 | 36.2 | 19.5 | 33.5 | 24.5 | 45.81 |
| 63.0 | 11.2 | 52.0 | 12.7 | 45.5 | 14.0 | 40.0 | 16.2 | 36.0 | 19.2 | 32.7 | 24.0 | 46.09 |
| 65.0 | 10.7 | 54.9 | 12.0 | 46.0 | 14.0 | 40.0 | 16.1 | 36.0 | 19.2 | 33.0 | 24.2 | 46.31 |
| 65.0 | 11.1 | 53.5 | 12.7 | 46.9 | 14.5 | 40.0 | 16.0 | 36.5 | 19.2 | 33.0 | 23.8 | 47.12 |
| 64.7 | 11.5 | 53.8 | 12.7 | 46.5 | 14.5 | 40.5 | 16.5 | 36.0 | 19.5 | 32.8 | 24.0 | 46.61 |
| 66.3 | 11.7 | 54.7 | 13.0 | 47.5 | 14.7 | 41.0 | 16.7 | 36.2 | 19.7 | 33.0 | 24.0 | 46.47 |
| 65.0 | 11.2 | 54.0 | 12.5 | 45.7 | 13.1 | 40.0 | 16.5 | 35.5 | 19.2 | 32.2 | 24.0 | 46.40 |
| 64.0 | 11.5 | 53.5 | 12.7 | 45.5 | 14.5 | 39.8 | 16.2 | 35.5 | 19.0 | 32.5 | 22.8 | 46.08 |
| 64.3 | 11.0 | 53.0 | 12.0 | 45.5 | 13.7 | 39.7 | 16.0 | 35.5 | 19.0 | 32.3 | 23.2 | 46.66 |
| 64.0 | 10.7 | 52.5 | 12.0 | 45.0 | 13.7 | 39.0 | 16.0 | 35.0 | 18.7 | 32.0 | 23.5 | 46.34 |
| 63.7 | 10.7 | 52.5 | 12.0 | 44.5 | 13.5 | 39.0 | 15.0 | 34.2 | 18.2 | 31.5 | 22.5 | 46.02 |
| 64.0 | 11.0 | 53.0 | 12.5 | 45.0 | 14.0 | 40.5 | 16.0 | 36.0 | 19.0 | 33.0 | 23.5 | 46.62 |
| 64.0 | 11.2 | 52.7 | 11.5 | 44.8 | 14.1 | 39.2 | 16.2 | 35.1 | 19.5 | 32.0 | 23.5 | 45.90 |
| 69.2 | 11.0 | 57.1 | 12.2 | 48.5 | 14.0 | 42.2 | 16.0 | 37.7 | 19.1 | 34.2 | 24.0 | 46.77 |
| 63.4 | 10.9 | 52.1 | 12.2 | 44.3 | 13.8 | 38.7 | 15.8 | 34.6 | 18.6 | 31.6 | 23.0 | 45.52 |

TA

HIGH PR.

| Date. | Time. | Forward Stroke. | | Back Stroke. | | At 0.05. | | At 0.15. | | At 0.25. | | At 0.3 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Initial. | Final. | Initial. | Final. | | Subtractive. | | Subtractive. | | Subtractive. | | |
| | | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 1 |
| Dec. 10.. | 9 A.M. | 89.7 | 31.0 | 28.0 | 46.5 | 89.0 | 27.0 | 88.5 | 9.7 | 88.0 | 10.6 | 69.7 | 1 |
| " | 10 " | 84.5 | 32.2 | 29.0 | 43.5 | 84.0 | 25.0 | 84.0 | 9.7 | 84.0 | 10.2 | 70.5 | 1 |
| " | 11 " | 37.5 | 33.7 | 29.5 | 49.5 | 87.0 | 27.5 | 86.1 | 10.5 | 85.0 | 10.5 | 78.6 | 11 |
| " | 12 M. | 80.5 | 33.0 | 30.0 | 47.5 | 80.0 | 27.5 | 80.0 | 10.5 | 80.0 | 10.5 | 77.5 | 11 |
| " | 1 P.M. | 85.7 | 33.0 | 28.5 | 46.5 | 85.0 | 26.0 | 84.5 | 10.5 | 84.0 | 10.0 | 78.0 | 11 |
| " | 2 " | 87.7 | 32.9 | 29.2 | 48.7 | 87.0 | 26.0 | 85.5 | 10.0 | 84.5 | 9.8 | 77.0 | 1 |
| " | 3 " | 88.0 | 32.1 | 27.5 | 48.0 | 87.5 | 26.0 | 87.5 | 10.2 | 81.0 | 10.5 | 77.2 | 1 |
| " | 4 " | 87.0 | 33.0 | 29.0 | 49.0 | 86.2 | 27.0 | 85.5 | 10.0 | 85.0 | 10.0 | 77.5 | 1 |
| " | 5 " | 88.2 | 32.7 | 28.9 | 49.0 | 87.5 | 27.0 | 87.0 | 10.0 | 85.1 | 10.0 | 88.0 | 1 |
| " | 6 " | 87.5 | 33.0 | 28.0 | 48.5 | 86.5 | 26.5 | 85.5 | 10.5 | 84.2 | 10.0 | 70.0 | 1 |
| " | 7 " | 88.7 | 31.2 | 28.0 | 47.5 | 88.0 | 26.0 | 87.0 | 8.5 | 85.5 | 9.0 | 70.5 | |
| " | 8 " | 88.0 | 33.0 | 29.2 | 50.0 | 87.0 | 28.0 | 86.5 | 10.5 | 85.5 | 10.0 | 80.5 | 1 |
| " | 9 " | 86.0 | 34.0 | 30.0 | 49.0 | 85.5 | 26.5 | 85.0 | 10.0 | 84.0 | 10.0 | 79.0 | 1 |
| " | 10 " | 86.2 | 34.0 | 29.7 | 47.2 | 84.5 | 26.5 | 84.5 | 10.2 | 83.0 | 10.0 | 78.5 | 1 |
| " | 11 " | 86.2 | 34.0 | 29.0 | 48.2 | 85.2 | 27.0 | 85.0 | 11.0 | 84.0 | 10.0 | 78.0 | 1 |
| Dec. 11.. | 12 M.N. | 84.5 | 34.5 | 30.0 | 48.5 | 84.0 | 28.0 | 83.5 | 10.0 | 82.7 | 10.5 | 81.0 | 1 |
| " | 1 A.M. | 84.2 | 34.7 | 30.3 | 48.5 | 83.5 | 28.5 | 83.0 | 10.5 | 82.2 | 9.7 | 81.5 | 1 |
| " | 2 " | 86.0 | 34.0 | 30.0 | 48.5 | 85.2 | 27.0 | 84.7 | 10.2 | 84.0 | 10.3 | 79.0 | 1 |
| " | 3 " | 87.0 | 33.5 | 29.0 | 47.7 | 85.7 | 25.0 | 85.1 | 10.0 | 84.5 | 10.2 | 78.0 | 1 |
| " | 4 " | 87.7 | 33.5 | 28.9 | 47.0 | 87.0 | 25.5 | 86.5 | 10.0 | 85.5 | 10.2 | 78.0 | 1 |
| " | 5 " | 88.0 | 33.7 | 29.0 | 47.9 | 86.5 | 28.5 | 85.0 | 11.0 | 84.1 | 10.0 | 71.0 | 1 |
| " | 6 " | 87.5 | 33.0 | 31.0 | 47.5 | 85.5 | 26.5 | 85.0 | 10.2 | 84.0 | 10.2 | 81.0 | 1 |
| " | 7 " | 86.2 | 33.0 | 32.0 | 47.5 | 85.0 | 26.5 | 84.7 | 10.2 | 84.0 | 10.2 | 77.0 | 1 |
| " | 8 " | 87.5 | 33.0 | 29.2 | 48.9 | 86.0 | 25.0 | 85.5 | 10.0 | 84.2 | 10.0 | 77.9 | 1 |
| " | 9 " | 87.9 | 32.9 | 29.0 | 49.2 | 86.7 | 27.0 | 86.2 | 10.0 | 84.5 | 9.7 | 77.0 | 1 |
| " | 10 " | 89.2 | 34.0 | 30.0 | 49.0 | 88.7 | 27.5 | 88.0 | 10.0 | 86.7 | 10.2 | 80.5 | 1 |
| " | 11 " | 87.2 | 33.8 | 30.0 | 49.0 | 87.0 | 27.0 | 86.2 | 9.7 | 85.0 | 9.6 | 77.7 | 1 |
| " | 12 M. | 87.2 | 33.0 | 28.7 | 50.0 | 86.5 | 26.5 | 85.5 | 10.0 | 84.5 | 9.2 | 77.0 | 1 |
| " | 1 P.M. | 85.7 | 31.2 | 27.7 | 48.7 | 85.7 | 27.7 | 85.7 | 10.0 | 84.2 | 9.2 | 72.7 | |
| " | 2 " | 86.0 | 32.2 | 28.2 | 49.7 | 85.7 | 29.7 | 85.7 | 10.7 | 83.7 | 9.2 | 76.7 | 1 |
| " | 3 " | 84.2 | 32.0 | 28.0 | 48.5 | 84.0 | 27.0 | 84.0 | 10.0 | 82.2 | 9.5 | 73.0 | 1 |
| " | 4 " | 85.7 | 32.0 | 28.0 | 49.5 | 85.0 | 29.0 | 85.0 | 11.0 | 83.5 | 9.5 | 75.5 | 1 |
| " | 5 " | 86.0 | 32.7 | 27.5 | 49.5 | 85.7 | 27.0 | 85.5 | 10.0 | 85.5 | 9.5 | 78.0 | 1 |
| " | 6 " | 86.7 | 31.7 | 27.2 | 49.5 | 86.7 | 27.7 | 86.7 | 10.0 | 84.7 | 9.7 | 73.7 | 1 |
| " | 7 " | 85.0 | 33.0 | 29.0 | 49.0 | 85.0 | 27.5 | 85.0 | 10.0 | 84.0 | 9.5 | 76.0 | 1 |
| " | 8 " | 82.8 | 32.5 | 28.7 | 49.0 | 82.0 | 25.0 | 82.2 | 10.0 | 81.0 | 9.0 | 76.0 | 1 |
| " | 9 " | 85.0 | 32.5 | 28.3 | 49.2 | 85.0 | 27.0 | 85.0 | 11.0 | 83.5 | 9.7 | 75.5 | 1 |
| " | 10 " | 84.2 | 32.5 | 27.9 | 48.7 | 84.0 | 25.5 | 84.0 | 10.0 | 82.7 | 9.0 | 74.0 | 1 |
| " | 11 " | 83.5 | 33.0 | 29.5 | 48.0 | 83.0 | 27.0 | 83.2 | 10.2 | 81.5 | 9.9 | 77.5 | 1 |
| Dec. 12.. | 12 M.N. | 83.2 | 33.0 | 28.5 | 48.0 | 82.7 | 25.2 | 82.5 | 10.2 | 81.5 | 9.5 | 77.0 | 1 |
| | 1 A.M. | 85.2 | 33.0 | 28.7 | 49.0 | 84.0 | 27.2 | 84.0 | 11.0 | 82.2 | 10.0 | 76.0 | 1 |
| " | 2 " | 85.0 | 32.7 | 28.0 | 47.5 | 84.2 | 27.0 | 84.2 | 10.7 | 83.5 | 9.6 | 75.0 | 1 |
| " | 3 " | 86.2 | 32.7 | 28.0 | 48.2 | 85.0 | 26.0 | 85.0 | 10.5 | 83.7 | 9.7 | 77.2 | 7 |
| " | 4 " | 82.5 | 31.0 | 28.0 | 49.5 | 81.2 | 28.0 | 81.2 | 10.2 | 80.5 | 10.5 | 74.0 | 1 |
| " | 5 " | 85.0 | 32.5 | 29.0 | 49.7 | 83.5 | 26.0 | 83.2 | 9.7 | 82.0 | 10.0 | 76.7 | 1 |
| " | 6 " | 86.7 | 32.0 | 29.0 | 48.7 | 84.7 | 24.7 | 83.7 | 9.7 | 83.0 | 9.7 | 74.5 | 1 |
| " | 7 " | 87.5 | 32.2 | 28.6 | 49.2 | 85.3 | 27.3 | 84.7 | 10.0 | 83.7 | 9.0 | 75.7 | 1 |
| " | 8 " | 84.2 | 32.0 | 28.3 | 48.2 | 83.5 | 24.7 | 83.5 | 10.5 | 82.7 | 10.6 | 74.0 | 1 |
| " | 9 " | 84.2 | 31.5 | 28.7 | 48.9 | 84.0 | 27.5 | 83.7 | 10.2 | 83.0 | 10.0 | 73.0 | 1 |
| " | 10 " | 86.5 | 32.0 | 28.0 | 50.5 | 85.5 | 27.0 | 85.0 | 10.0 | 84.0 | 9.5 | 74.0 | 1 |
| " | 11 " | 86.2 | 32.0 | 28.3 | 50.5 | 85.0 | 25.2 | 85.0 | 9.7 | 84.0 | 9.2 | 73.0 | 1 |
| " | 12 M. | 84.0 | 31.7 | 28.0 | 49.7 | 83.0 | 25.5 | 83.7 | 9.5 | 83.0 | 9.2 | 72.5 | 1 |
| " | 1 P.M. | 85.7 | 32.0 | 28.9 | 51.0 | 85.0 | 28.0 | 85.0 | 10.2 | 84.0 | 10.0 | 74.0 | 1 |
| " | 2 " | 86.2 | 32.7 | 28.6 | 50.2 | 85.5 | 25.0 | 85.5 | 10.2 | 85.0 | 10.0 | 76.0 | 1 |
| " | 3 " | 85.0 | 33.0 | 27.0 | 50.0 | 84.1 | 25.0 | 84.0 | 10.0 | 83.0 | 9.0 | 75.7 | 1 |
| Average.. | ......... | 86.0 | 32.3 | 28.7 | 48.6 | 85.1 | 26.6 | 84.8 | 10.1 | 83.7 | 9.8 | 76.2 | 1 |

rt.

## SURE.—BOTTOM.

| At 0.45. | | At 0.55. | | At 0.65. | | At 0.75. | | At 0.85. | | At 0.95. | | Net Average. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Subtractive. | | Subtractive. | | Subtractive. | | Subtractive. | | Subtractive. | | Subtractive. | |
| 13. | 14. | 15. | 16. | 17. | 18. | 19. | 20. | 21. | 22. | 23. | 24. | 25. |
| 51.1 | 12.0 | 48.2 | 13.2 | 42.5 | 14.7 | 38.5 | 17.0 | 34.5 | 20.5 | 31.7 | 25.0 | 42.19 |
| 57.0 | 11.5 | 49.0 | 13.0 | 43.0 | 15.2 | 39.0 | 18.0 | 35.5 | 21.0 | 33.0 | 26.0 | 41.84 |
| 62.0 | 12.5 | 52.0 | 13.5 | 45.2 | 15.5 | 40.5 | 18.0 | 37.0 | 21.9 | 34.5 | 27.0 | 43.99 |
| 60.5 | 12.0 | 51.0 | 13.5 | 45.0 | 15.5 | 39.5 | 14.9 | 37.0 | 21.5 | 34.0 | 26.5 | 42.11 |
| 61.5 | 12.0 | 50.2 | 13.5 | 44.5 | 15.0 | 40.0 | 17.5 | 36.0 | 21.0 | 34.0 | 26.0 | 43.42 |
| 61.0 | 11.5 | 50.0 | 13.0 | 44.0 | 14.7 | 39.2 | 17.5 | 36.0 | 21.0 | 33.7 | 26.2 | 43.77 |
| 61.0 | 12.1 | 51.5 | 13.7 | 44.2 | 14.7 | 39.0 | 17.2 | 36.0 | 20.7 | 33.0 | 25.5 | 43.60 |
| 61.0 | 12.0 | 52.0 | 13.5 | 45.0 | 15.0 | 40.2 | 17.7 | 36.7 | 21.0 | 34.0 | 26.0 | 44.00 |
| 62.0 | 11.9 | 52.0 | 13.0 | 44.5 | 14.7 | 40.2 | 17.0 | 36.5 | 20.5 | 34.0 | 26.0 | 44.57 |
| 56.5 | 11.7 | 50.5 | 13.0 | 44.7 | 15.0 | 39.7 | 17.0 | 36.5 | 20.0 | 34.2 | 24.5 | 42.95 |
| 57.0 | 10.5 | 49.0 | 12.0 | 42.1 | 13.5 | 38.0 | 15.7 | 34.7 | 18.0 | 32.5 | 22.7 | 43.85 |
| 63.0 | 12.0 | 53.1 | 13.2 | 46.0 | 15.0 | 41.7 | 17.5 | 37.8 | 21.0 | 35.0 | 26.5 | 45.16 |
| 62.2 | 12.2 | 54.0 | 13.7 | 46.5 | 15.5 | 41.5 | 18.5 | 38.0 | 21.5 | 36.0 | 27.0 | 44.57 |
| 63.0 | 12.2 | 53.0 | 14.0 | 46.0 | 15.5 | 41.5 | 18.0 | 37.7 | 21.0 | 35.1 | 26.5 | 44.18 |
| 62.0 | 12.0 | 51.5 | 13.0 | 44.9 | 15.1 | 41.0 | 18.0 | 37.2 | 21.2 | 34.5 | 27.0 | 43.93 |
| 63.5 | 12.1 | 54.0 | 13.9 | 47.2 | 15.5 | 42.5 | 18.0 | 38.7 | 22.0 | 35.5 | 27.0 | 44.37 |
| 64.5 | 12.0 | 53.5 | 13.0 | 48.0 | 15.5 | 42.0 | 18.2 | 38.0 | 22.0 | 35.5 | 27.0 | 44.42 |
| 62.0 | 12.2 | 51.9 | 13.7 | 45.0 | 16.0 | 40.8 | 18.0 | 37.5 | 21.0 | 34.7 | 27.0 | 43.82 |
| 61.5 | 12.0 | 52.5 | 13.7 | 46.2 | 15.7 | 41.0 | 17.5 | 37.5 | 21.0 | 34.5 | 26.5 | 44.38 |
| 61.7 | 12.0 | 52.0 | 13.5 | 46.0 | 15.7 | 40.5 | 17.7 | 37.7 | 21.0 | 34.7 | 26.5 | 44.65 |
| 57.8 | 12.0 | 50.0 | 13.0 | 44.0 | 14.7 | 40.0 | 17.0 | 36.7 | 20.0 | 34.2 | 24.5 | 42.76 |
| 64.0 | 12.0 | 54.0 | 13.6 | 47.0 | 15.2 | 42.0 | 18.0 | 37.2 | 21.5 | 35.0 | 27.0 | 44.94 |
| 61.0 | 12.0 | 51.0 | 14.0 | 45.0 | 15.5 | 40.5 | 17.7 | 37.0 | 21.5 | 34.2 | 26.5 | 43.42 |
| 61.7 | 11.7 | 52.5 | 13.2 | 45.5 | 15.2 | 40.2 | 18.0 | 37.0 | 21.2 | 34.2 | 27.0 | 44.26 |
| 61.0 | 11.2 | 52.0 | 13.0 | 45.0 | 14.7 | 40.6 | 27.0 | 37.0 | 20.5 | 33.7 | 26.0 | 44.43 |
| 63.5 | 12.0 | 52.7 | 13.5 | 46.0 | 15.5 | 41.2 | 17.9 | 37.5 | 21.5 | 35.0 | 26.7 | 45.41 |
| 62.0 | 11.5 | 52.9 | 13.0 | 45.0 | 14.7 | 41.0 | 17.0 | 37.0 | 20.7 | 34.5 | 26.0 | 44.88 |
| 61.0 | 11.1 | 52.0 | 12.5 | 45.2 | 14.7 | 41.0 | 17.0 | 36.7 | 20.7 | 34.1 | 26.1 | 44.56 |
| 57.2 | 11.2 | 84.2 | 12.7 | 42.5 | 15.5 | 38.2 | 16.2 | 34.7 | 19.2 | 32.2 | 23.7 | 42.62 |
| 60.7 | 11.5 | 50.7 | 12.7 | 43.7 | 14.2 | 39.2 | 15.5 | 35.7 | 19.5 | 33.2 | 24.2 | 43.76 |
| 57.0 | 11.5 | 40.9 | 13.0 | 42.0 | 14.7 | 38.0 | 17.0 | 35.0 | 20.5 | 32.5 | 25.0 | 41.82 |
| 59.5 | 11.7 | 49.5 | 13.0 | 43.5 | 14.7 | 39.0 | 17.2 | 35.7 | 20.2 | 33.1 | 26.0 | 42.62 |
| 59.5 | 11.5 | 50.2 | 12.7 | 44.0 | 14.7 | 39.5 | 16.7 | 36.0 | 20.0 | 33.5 | 25.0 | 44.00 |
| 58.2 | 11.7 | 49.2 | 13.7 | 42.7 | 14.7 | 38.7 | 17.2 | 34.7 | 20.7 | 32.7 | 25.2 | 42.67 |
| 59.2 | 11.5 | 50.0 | 13.0 | 43.7 | 14.7 | 39.5 | 17.0 | 36.5 | 20.5 | 33.7 | 25.5 | 43.32 |
| 59.5 | 11.2 | 50.5 | 13.0 | 44.0 | 14.7 | 39.0 | 17.0 | 35.8 | 20.2 | 33.2 | 25.5 | 42.73 |
| 59.5 | 11.4 | 50.0 | 13.0 | 43.5 | 14.7 | 39.0 | 17.0 | 36.0 | 20.5 | 33.5 | 25.9 | 42.96 |
| 58.2 | 11.2 | 49.0 | 12.7 | 42.5 | 14.7 | 38.5 | 16.7 | 35.2 | 20.0 | 33.0 | 25.0 | 42.62 |
| 60.0 | 12.0 | 50.7 | 13.1 | 44.5 | 14.7 | 40.0 | 17.5 | 36.7 | 21.0 | 34.0 | 26.0 | 42.90 |
| 60.0 | 11.5 | 51.0 | 13.2 | 44.2 | 14.7 | 39.7 | 17.0 | 36.2 | 20.5 | 33.9 | 25.7 | 43.06 |
| 60.5 | 11.9 | 51.0 | 12.2 | 44.5 | 15.0 | 40.0 | 17.0 | 36.5 | 20.5 | 33.7 | 26.0 | 43.01 |
| 59.0 | 11.5 | 49.5 | 13.0 | 43.5 | 14.7 | 39.0 | 17.0 | 35.8 | 20.5 | 33.5 | 26.0 | 42.70 |
| 59.2 | 12.0 | 50.2 | 13.2 | 44.0 | 14.7 | 39.2 | 17.0 | 36.0 | 20.7 | 33.5 | 26.0 | 43.22 |
| 58.7 | 11.5 | 49.5 | 13.0 | 43.0 | 14.7 | 38.0 | 16.5 | 34.2 | 20.0 | 31.9 | 24.7 | 41.20 |
| 60.5 | 11.5 | 50.7 | 13.0 | 44.2 | 14.7 | 39.5 | 16.7 | 35.7 | 20.5 | 33.2 | 25.7 | 43.17 |
| 58.7 | 11.2 | 49.7 | 13.0 | 43.2 | 14.5 | 38.7 | 16.7 | 35.2 | 20.2 | 32.7 | 25.7 | 42.83 |
| 59.7 | 11.5 | 50.7 | 12.7 | 44.0 | 14.5 | 39.2 | 16.7 | 35.9 | 20.2 | 33.2 | 25.7 | 43.42 |
| 58.2 | 11.9 | 49.0 | 13.2 | 43.0 | 14.7 | 38.5 | 17.0 | 35.2 | 20.2 | 33.0 | 25.5 | 42.12 |
| 57.5 | 11.7 | 48.2 | 13.0 | 42.0 | 14.7 | 38.0 | 17.0 | 34.2 | 20.1 | 32.0 | 25.0 | 41.58 |
| 57.5 | 11.5 | 49.5 | 12.8 | 43.0 | 14.7 | 38.9 | 17.0 | 35.2 | 20.2 | 33.0 | 25.5 | 42.71 |
| 57.0 | 11.5 | 49.5 | 13.0 | 43.0 | 14.7 | 38.9 | 17.0 | 35.5 | 20.4 | 33.0 | 25.2 | 42.72 |
| 57.0 | 11.5 | 49.0 | 13.0 | 42.7 | 14.7 | 38.0 | 16.5 | 33.0 | 20.0 | 32.2 | 25.0 | 41.90 |
| 57.5 | 12.0 | 49.5 | 13.1 | 43·0 | 15.0 | 39.0 | 17.1 | 35.5 | 20.5 | 33.0 | 25.5 | 42.30 |
| 59.7 | 11.7 | 50.2 | 13.2 | 44.0 | 15.0 | 39.4 | 17.2 | 36.0 | 20.5 | 33.2 | 25.5 | 43.57 |
| 60.0 | 11.5 | 51.0 | 13.0 | 44.2 | 14.7 | 39.8 | 16.7 | 36.2 | 20.5 | 33.7 | 26.0 | 43.51 |
| 59.9 | 11.7 | 50.7 | 13.1 | 44.2 | 14.9 | 39.7 | 17.1 | 36.2 | 20.6 | 33.6 | 25.7 | 43.38 |

TABLE

LOW PRES

| Date. | Time. | Forward Stroke. | | Back Stroke. | | At 0.05. | | At 0.15. | | At 0.25. | | At 0.35. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Initial. | Final. | Initial. | Final. | | Subtractive. | | Subtractive. | | Subtractive. | | Subtractive. |
| | | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. |
| Dec. 10.. | 9 A.M. | 27.5 | 6.9 | 2.4 | 8.0 | 24.2 | 1.5 | 19.5 | 1.5 | 16.0 | 1.5 | 13.7 | 1.4 |
| " | 10 " | 26.0 | 7.2 | 3.0 | 8.0 | 24.5 | 1.7 | 19.5 | 1.7 | 16.2 | 1.7 | 14.0 | 1.7 |
| " | 11 " | 29.7 | 7.6 | 4.0 | 9.0 | 26.2 | 2.2 | 20.7 | 1.7 | 17.2 | 2.0 | 15.0 | 2.0 |
| " | 12 M.D. | 29.4 | 7.1 | 3.4 | 8.5 | 25.5 | 2.1 | 20.5 | 1.7 | 16.5 | 1.7 | 14.5 | 1.7 |
| " | 1 P.M. | 27.9 | 6.9 | 3.5 | 8.5 | 24.5 | 1.9 | 19.6 | 1.5 | 16.3 | 1.5 | 14.0 | 1.7 |
| " | 2 " | 28.5 | 6.9 | 2.2 | 8.8 | 25.2 | 2.0 | 19.8 | 1.5 | 16.0 | 1.5 | 14.0 | 1.7 |
| " | 3 " | 27.8 | 7.4 | 3.4 | 9.0 | 24.7 | 2.0 | 19.5 | 1.8 | 14.5 | 1.8 | 14.0 | 1.9 |
| " | 4 " | 29.0 | 7.1 | 3.3 | 9.0 | 25.5 | 2.1 | 20.0 | 1.7 | 16.7 | 1.9 | 14.5 | 1.9 |
| " | 5 " | 28.6 | 7.0 | 3.2 | 8.4 | 25.0 | 1.9 | 19.7 | 1.5 | 16.3 | 1.6 | 14.0 | 1.6 |
| " | 6 " | 27.9 | 7.0 | 3.3 | 8.9 | 25.0 | 2.0 | 19.7 | 1.5 | 16.4 | 1.5 | 14.0 | 1.5 |
| " | 7 " | 27.4 | 7.0 | 3.2 | 8.7 | 24.5 | 2.0 | 19.6 | 1.7 | 16.6 | 1.8 | 14.1 | 1.8 |
| " | 8 " | 28.4 | 6.5 | 4.0 | 8.9 | 25.0 | 2.0 | 19.7 | 1.5 | 16.6 | 1.5 | 14.0 | 1.6 |
| " | 9 " | 29.0 | 7.2 | 4.0 | 8.7 | 25.0 | 2.0 | 19.9 | 1.5 | 16.5 | 1.5 | 14.2 | 1.7 |
| " | 10 " | 28.6 | 7.3 | 3.4 | 9.0 | 25.5 | 2.0 | 20.3 | 1.6 | 17.0 | 1.7 | 14.6 | 1.7 |
| " | 11 " | 29.0 | 7.4 | 3.5 | 10.2 | 25.3 | 2.0 | 20.1 | 1.5 | 16.8 | 1.6 | 14.5 | 1.7 |
| Dec. 11.. | 12 M. | 29.7 | 7.2 | 3.3 | 8.8 | 25.8 | 2.1 | 20.4 | 1.7 | 16.9 | 1.7 | 14.7 | 1.7 |
| " | 1 A.M. | 28.7 | 7.1 | 3.0 | 9.0 | 25.3 | 2.0 | 19.9 | 1.5 | 16.7 | 1.6 | 14.3 | 1.7 |
| " | 2 " | 29.0 | 6.9 | 3.2 | 9.0 | 24.6 | 2.0 | 19.4 | 1.4 | 16.1 | 1.4 | 13.9 | 1.4 |
| " | 3 " | 28.0 | 7.0 | 3.3 | 9.2 | 24.6 | 2.0 | 19.7 | 1.5 | 16.3 | 1.7 | 13.9 | 1.6 |
| " | 4 " | 28.0 | 6.9 | 3.0 | 9.0 | 25.0 | 2.0 | 19.6 | 1.4 | 16.3 | 1.5 | 14.0 | 1.6 |
| " | 5 " | 28.7 | 6.8 | 3.0 | 8.4 | 25.1 | 2.0 | 19.6 | 1.5 | 16.4 | 1.5 | 13.8 | 1.6 |
| " | 6 " | 29.0 | 7.6 | 3.8 | 9.0 | 25.7 | 2.0 | 20.3 | 2.1 | 17.0 | 2.1 | 14.7 | 2.1 |
| " | 7 " | 29.0 | 7.2 | 3.3 | 9.3 | 25.4 | 2.0 | 20.0 | 1.6 | 16.6 | 1.7 | 14.2 | 1.7 |
| " | 8 " | 28.6 | 7.1 | 3.1 | 9.0 | 24.8 | 1.9 | 19.6 | 1.5 | 16.3 | 1.5 | 14.0 | 1.6 |
| " | 9 " | 28.0 | 7.0 | 3.0 | 9.5 | 24.9 | 2.3 | 19.4 | 1.7 | 16.2 | 1.8 | 14.0 | 1.8 |
| " | 10 " | 27.0 | 7.0 | 3.4 | 8.9 | 24.7 | 1.9 | 19.6 | 1.5 | 16.1 | 1.6 | 13.8 | 1.6 |
| " | 11 " | 28.1 | 7.0 | 3.5 | 8.9 | 25.0 | 2.0 | 19.5 | 1.7 | 16.5 | 1.7 | 14.0 | 1.7 |
| " | 12 M. | 29.3 | 7.6 | 4.0 | 9.5 | 26.0 | 2.7 | 20.5 | 2.4 | 17.1 | 2.4 | 15.0 | 2.5 |
| " | 1 P.M. | 27.6 | 7.5 | 3.7 | 9.1 | 25.2 | 2.0 | 20.0 | 2.0 | 16.6 | 2.0 | 14.2 | 2.0 |
| " | 2 " | 27.3 | 7.2 | 3.5 | 9.5 | 25.2 | 1.7 | 20.0 | 1.7 | 16.5 | 1.7 | 14.0 | 1.7 |
| " | 3 " | 27.0 | 7.3 | 3.6 | 9.2 | 24.5 | 1.7 | 19.0 | 1.5 | 16.1 | 1.5 | 14.0 | 1.5 |
| " | 4 " | 28.0 | 7.3 | 4.0 | 9.2 | 26.0 | 1.9 | 20.1 | 1.8 | 17.0 | 1.8 | 14.7 | 1.9 |
| " | 5 " | 25.5 | 6.0 | 3.0 | 9.0 | 24.4 | 2.0 | 19.8 | 1.9 | 16.8 | 1.8 | 14.7 | 2.0 |
| " | 6 " | 27.3 | 7.5 | 4.0 | 8.5 | 25.2 | 2.0 | 19.1 | 2.0 | 16.8 | 2.0 | 14.1 | 2.0 |
| " | 7 " | 28.1 | 7.0 | 3.0 | 9.0 | 25.0 | 2.0 | 19.8 | 1.5 | 16.5 | 1.5 | 14.0 | 1.6 |
| " | 8 " | 28.8 | 7.2 | 3.2 | 9.0 | 25.3 | 2.1 | 20.1 | 1.5 | 16.3 | 1.5 | 14.1 | 1.6 |
| " | 9 " | 28.9 | 7.2 | 3.6 | 8.5 | 26.1 | 1.8 | 20.6 | 1.7 | 17.0 | 1.7 | 14.6 | 1.7 |
| " | 10 " | 28.0 | 7.2 | 4.0 | 8.3 | 26.0 | 1.7 | 20.5 | 1.6 | 17.0 | 1.5 | 14.6 | 1.7 |
| " | 11 " | 27.8 | 7.3 | 4.1 | 6.7 | 25.5 | 1.7 | 20.3 | 1.7 | 17.0 | 1.7 | 14.7 | 1.7 |
| Dec. 12.. | 12 M.N. | 28.7 | 7.2 | 3.6 | 8.9 | 26.0 | 2.0 | 20.5 | 1.6 | 17.1 | 1.6 | 14.7 | 1.6 |
| " | 1 A.M. | 28.6 | 7.2 | 3.7 | 8.9 | 25.7 | 1.7 | 20.5 | 1.5 | 17.0 | 1.5 | 14.6 | 1.5 |
| " | 2 " | 28.0 | 7.2 | 3.6 | 9.2 | 25.2 | 1.9 | 20.0 | 1.5 | 16.7 | 1.5 | 14.1 | 1.7 |
| " | 3 " | 27.9 | 7.1 | 3.6 | 9.5 | 25.4 | 1.7 | 20.0 | 1.4 | 16.8 | 1.5 | 14.2 | 1.5 |
| " | 4 " | 27.8 | 7.2 | 3.5 | 9.9 | 25.0 | 2.0 | 20.0 | 1.5 | 16.5 | 1.5 | 14.0 | 1.5 |
| " | 5 " | 28.4 | 7.2 | 3.3 | 9.9 | 25.8 | 1.6 | 20.4 | 1.2 | 16.8 | 1.3 | 14.7 | 1.4 |
| " | 6 " | 27.9 | 7.6 | 4.0 | 8.0 | 25.7 | 1.8 | 20.4 | 1.7 | 17.0 | 1.8 | 14.6 | 1.8 |
| " | 7 " | 28.4 | 7.3 | 3.6 | 8.5 | 25.4 | 1.8 | 20.1 | 1.5 | 16.7 | 1.5 | 14.2 | 1.6 |
| " | 8 " | 28.2 | 7.5 | 3.8 | 8.0 | 26.0 | 2.0 | 20.8 | 2.0 | 17.0 | 2.0 | 14.5 | 2.0 |
| " | 9 " | 27.1 | 7.4 | 3.9 | 9.5 | 24.8 | 2.0 | 19.8 | 1.7 | 16.6 | 1.7 | 14.2 | 1.8 |
| " | 10 " | 26.2 | 7.2 | 3.7 | 8.4 | 24.5 | 1.7 | 19.5 | 1.5 | 16.5 | 1.7 | 14.0 | 1.5 |
| " | 11 " | 27.7 | 7.2 | 3.3 | 8.5 | 24.7 | 1.9 | 19.7 | 1.2 | 16.5 | 1.5 | 14.0 | 1.5 |
| " | 12 M. | 28.0 | 7.1 | 3.5 | 9.8 | 25.0 | 1.9 | 20.0 | 1.5 | 16.7 | 1.6 | 14.0 | 1.7 |
| " | 1 P.M. | 28.2 | 7.0 | 3.2 | 9.2 | 25.0 | 2.0 | 20.0 | 1.5 | 16.1 | 1.4 | 13.5 | 1.5 |
| " | 2 " | 28.0 | 7.0 | 3.3 | 8.8 | 25.7 | 2.0 | 20.2 | 1.5 | 16.8 | 1.4 | 14.2 | 1.3 |
| " | 3 " | 28.2 | 6.9 | 3.0 | 8.1 | 25.0 | 1.6 | 19.9 | 1.5 | 16.6 | 1.5 | 14.2 | 1.5 |
| Average. ......... | | 28.0 | 7.1 | 3.3 | 8.9 | 25.2 | 1.9 | 19.9 | 1.6 | 16.5 | 1.6 | 14.2 | 1.7 |

II.

## SURE.—BOTTOM.

| At 0.45. | | At 0.55. | | At 0.65. | | At 0.75. | | At 0.85. | | At 0.95. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Subtractive. | | Subtractive. | | Subtractive. | | Subtractive. | | Subtractive. | | Subtractive. | Net Average. |
| 13. | 14. | 15. | 16. | 17. | 18. | 19. | 20. | 21. | 22. | 23. | 24. | 25. |
| 12.0 | 1.4 | 10.9 | 1.5 | 9.7 | 1.5 | 9.0 | 1.5 | 8.0 | 1.5 | 7.2 | 2.0 | 11.51 |
| 12.2 | 1.8 | 11.0 | 1.8 | 10.0 | 1.9 | 9.1 | 2.0 | 8.4 | 2.1 | 7.5 | 2.5 | 11.34 |
| 13.1 | 2.1 | 12.0 | 2.2 | 10.9 | 2.4 | 10.0 | 2.5 | 9.2 | 3.0 | 8.5 | 3.5 | 11.92 |
| 12.5 | 1.9 | 11.2 | 2.0 | 10.1 | 2.0 | 9.2 | 2.1 | 8.5 | 2.2 | 7.7 | 3.0 | 11.57 |
| 12.2 | 1.8 | 10.8 | 1.8 | 9.9 | 1.9 | 9.0 | 2.0 | 8.2 | 2.2 | 7.4 | 2.8 | 11.27 |
| 12.3 | 1.7 | 10.9 | 1.7 | 9.9 | 1.8 | 9.0 | 1.9 | 8.3 | 2.1 | 7.3 | 2.8 | 11.39 |
| 12.3 | 1.9 | 11.0 | 1.9 | 9.8 | 2.0 | 9.0 | 2.1 | 8.5 | 2.3 | 7.7 | 3.0 | 11.01 |
| 12.7 | 1.9 | 11.4 | 2.0 | 10.2 | 2.0 | 9.3 | 2.0 | 8.5 | 2.2 | 7.7 | 3.0 | 11.58 |
| 12.3 | 1.7 | 11.0 | 1.8 | 10.0 | 1.8 | 9.0 | 2.0 | 8.4 | 2.1 | 7.5 | 2.7 | 11.44 |
| 12.3 | 1.7 | 11.0 | 1.7 | 10.0 | 1.8 | 9.0 | 1.9 | 8.5 | 2.0 | 7.5 | 2.7 | 11.50 |
| 12.6 | 1.8 | 11.1 | 1.9 | 10.1 | 2.0 | 9.3 | 2.1 | 8.6 | 2.3 | 7.7 | 3.0 | 11.37 |
| 12.5 | 1.7 | 11.0 | 1.7 | 10.0 | 1.9 | 9.0 | 2.5 | 8.2 | 2.2 | 7.5 | 2.7 | 11.46 |
| 12.5 | 1.7 | 11.2 | 1.7 | 10.1 | 2.0 | 9.2 | 2.0 | 8.7 | 2.2 | 7.7 | 2.7 | 11.59 |
| 12.8 | 1.7 | 11.3 | 1.7 | 10.3 | 1.8 | 9.4 | 2.0 | 8.6 | 2.2 | 7.9 | 2.8 | 11.83 |
| 12.6 | 1.7 | 11.3 | 1.9 | 10.0 | 1.9 | 9.3 | 2.0 | 8.6 | 2.1 | 7.9 | 2.5 | 11.75 |
| 12.7 | 1.8 | 11.3 | 1.8 | 10.2 | 1.8 | 9.3 | 1.9 | 8.7 | 2.1 | 7.8 | 2.8 | 11.83 |
| 12.6 | 1.7 | 11.0 | 1.7 | 10.0 | 1.9 | 9.3 | 2.0 | 8.6 | 2.2 | 7.6 | 2.9 | 11.59 |
| 12.0 | 1.5 | 10.3 | 1.7 | 9.8 | 1.7 | 8.9 | 1.8 | 8.0 | 2.0 | 7.3 | 2.8 | 11.31 |
| 12.2 | 1.7 | 10.9 | 1.7 | 9.9 | 1.8 | 9.1 | 2.0 | 8.4 | 2.2 | 7.5 | 2.9 | 11.34 |
| 12.2 | 1.6 | 10.9 | 1.6 | 9.7 | 1.7 | 8.9 | 1.8 | 8.2 | 2.0 | 7.1 | 2.7 | 11.38 |
| 12.2 | 1.6 | 10.8 | 1.7 | 9.8 | 1.7 | 9.0 | 1.8 | 8.1 | 2.0 | 7.3 | 2.7 | 11.39 |
| 13.0 | 2.1 | 11.7 | 2.2 | 10.6 | 2.4 | 9.8 | 2.7 | 9.0 | 2.8 | 8.0 | 3.6 | 11.56 |
| 12.7 | 1.7 | 11.1 | 1.8 | 10.0 | 1.8 | 9.1 | 2.0 | 8.4 | 2.0 | 7.6 | 3.0 | 11.57 |
| 12.3 | 1.7 | 11.0 | 1.8 | 10.0 | 2.0 | 9.1 | 2.0 | 8.6 | 2.2 | 7.7 | 2.8 | 11.43 |
| 12.0 | 1.9 | 10.9 | 1.9 | 9.9 | 1.9 | 9.0 | 2.0 | 8.2 | 2.1 | 7.5 | 2.8 | 11.17 |
| 12.1 | 1.7 | 11.0 | 1.8 | 10.0 | 1.9 | 9.0 | 2.0 | 8.2 | 2.2 | 7.5 | 3.0 | 11.27 |
| 12.6 | 1.8 | 11.2 | 1.8 | 10.0 | 1.9 | 9.2 | 2.1 | 8.4 | 2.2 | 7.6 | 3.1 | 11.38 |
| 13.0 | 2.5 | 11.9 | 2.6 | 10.8 | 2.7 | 9.9 | 2.8 | 9.1 | 3.0 | 8.2 | 3.7 | 11.52 |
| 12.4 | 2.0 | 11.3 | 2.0 | 10.2 | 2.2 | 9.6 | 2.4 | 8.9 | 2.6 | 8.0 | 3.2 | 11.40 |
| 12.2 | 1.7 | 10.7 | 1.8 | 9.9 | 1.9 | 9.0 | 2.0 | 8.4 | 2.4 | 7.7 | 3.0 | 11.38 |
| 12.1 | 1.5 | 11.0 | 1.5 | 10.1 | 1.8 | 9.0 | 2.2 | 8.2 | 2.5 | 7.7 | 3.0 | 11.32 |
| 12.9 | 2.0 | 11.6 | 2.0 | 10.5 | 2.1 | 9.6 | 2.4 | 8.9 | 2.7 | 8.0 | 3.3 | 11.74 |
| 12.7 | 2.0 | 11.5 | 2.0 | 10.5 | 2.1 | 9.9 | 2.3 | 9.0 | 2.5 | 8.2 | 3.1 | 11.59 |
| 12.8 | 2.0 | 11.1 | 2.0 | 10.1 | 2.1 | 9.6 | 2.2 | 8.9 | 2.8 | 8.0 | 3.5 | 11.20 |
| 12.0 | 1.5 | 10.9 | 1.7 | 9.8 | 1.8 | 9.0 | 1.9 | 8.3 | 2.0 | 7.3 | 2.5 | 11.45 |
| 12.1 | 1.6 | 11.0 | 1.7 | 10.0 | 1.8 | 9.2 | 1.9 | 8.3 | 2.0 | 7.8 | 2.7 | 11.57 |
| 12.7 | 1.7 | 11.2 | 1.8 | 10.1 | 1.8 | 9.1 | 1.9 | 8.6 | 2.0 | 7.8 | 2.8 | 11.89 |
| 12.7 | 1.7 | 11.5 | 1.7 | 10.5 | 1.7 | 9.6 | 1.8 | 8.9 | 2.5 | 8.0 | 3.1 | 12.01 |
| 12.7 | 1.9 | 11.4 | 1.9 | 10.5 | 2.0 | 9.6 | 2.2 | 9.0 | 2.5 | 8.2 | 3.5 | 11.80 |
| 12.7 | 1.7 | 11.2 | 1.7 | 10.1 | 1.8 | 9.4 | 2.0 | 8.5 | 2.5 | 7.8 | 3.0 | 11.85 |
| 12.7 | 1.6 | 11.2 | 1.7 | 10.2 | 1.8 | 9.5 | 2.0 | 8.7 | 2.4 | 7.9 | 2.9 | 11.94 |
| 12.2 | 1.7 | 11.0 | 1.7 | 10.0 | 1.9 | 9.2 | 2.0 | 8.5 | 2.2 | 7.8 | 2.9 | 11.57 |
| 12.4 | 1.5 | 11.2 | 1.5 | 10.1 | 1.7 | 9.3 | 1.8 | 8.7 | 2.1 | 7.9 | 2.9 | 11.83 |
| 12.0 | 1.5 | 11.0 | 1.5 | 10.0 | 1.6 | 9.2 | 1.7 | 8.5 | 2.0 | 7.7 | 2.7 | 11.63 |
| 12.7 | 1.5 | 11.2 | 1.6 | 10.0 | 1.7 | 9.2 | 1.7 | 8.8 | 2.0 | 7.8 | 2.5 | 12.09 |
| 12.7 | 1.8 | 11.4 | 1.8 | 10.5 | 1.9 | 9.6 | 2.0 | 8.8 | 2.2 | 8.0 | 3.2 | 11.87 |
| 12.2 | 1.5 | 10.9 | 1.6 | 10.0 | 1.7 | 9.2 | 1.7 | 8.5 | 2.0 | 7.7 | 2.8 | 11.78 |
| 12.7 | 2.0 | 11.2 | 2.1 | 10.3 | 2.1 | 9.5 | 2.2 | 8.8 | 2.5 | 8.0 | 3.0 | 11.69 |
| 12.5 | 1.8 | 11.2 | 1.9 | 10.2 | 1.9 | 9.5 | 2.0 | 8.7 | 2.4 | 8.0 | 2.9 | 11.43 |
| 12.2 | 1.7 | 10.9 | 1.7 | 9.9 | 1.9 | 9.2 | 2.0 | 8.5 | 2.4 | 7.7 | 3.0 | 11.36 |
| 12.6 | 1.5 | 11.2 | 1.5 | 10.2 | 1.8 | 9.2 | 2.0 | 8.2 | 2.1 | 7.5 | 2.8 | 11.61 |
| 12.1 | 1.7 | 11.0 | 1.8 | 10.0 | 1.9 | 9.2 | 2.0 | 8.5 | 2.2 | 7.6 | 2.8 | 11.58 |
| 12.0 | 1.6 | 10.7 | 1.6 | 9.9 | 1.7 | 9.0 | 1.7 | 8.1 | 2.0 | 7.4 | 2.9 | 11.36 |
| 12.1 | 1.3 | 11.0 | 1.5 | 9.9 | 1.6 | 9.0 | 1.7 | 8.2 | 2.0 | 7.5 | 2.6 | 11.77 |
| 12.3 | 1.6 | 10.8 | 1.7 | 9.9 | 1.8 | 9.0 | 2.0 | 8.2 | 2.2 | 7.5 | 2.5 | 11.55 |
| 12.4 | 1.7 | 11.1 | 1.8 | 10.0 | 1.8 | 9.2 | 2.0 | 8.5 | 2.2 | 7.7 | 2.9 | 11.55 |

TA

LOW PI

| Date. | Time. | Forward Stroke. | | Back Stroke. | | At 0.05. | | At 0.15. | | At 0.25. | | At 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Initial. | Final. | Initial. | Final. | | Subtractive. | | Subtractive. | | Subtractive. | |
| | | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. |
| Dec. 10.. | 9 A.M. | 24.0 | 6.5 | 2.2 | 10.5 | 21.5 | 2.0 | 17.5 | 1.6 | 14.7 | 1.7 | 12.5 |
| " | 10 " | 24.5 | 6.2 | 2.5 | 11.0 | 22 0 | 2.0 | 17.1 | 1.5 | 14.5 | 1.5 | 12.2 |
| " | 11 " | 26.5 | 7.7 | 4.5 | 12.5 | 23.9 | 2.7 | 19.0 | 2.2 | 16.0 | 2.2 | 13.5 |
| " | 12 " | 26.5 | 7.1 | 3.2 | 11.2 | 22.5 | 2.2 | 18.1 | 1.6 | 15.1 | 1.7 | 13.1 |
| " | 1 P.M. | 25.5 | 7.1 | 4.0 | 11.9 | 22.5 | 2.2 | 18.2 | 2.2 | 15.4 | 2.2 | 13.3 |
| " | 2 " | 25.3 | 6.7 | 3.4 | 11.8 | 22.4 | 2.1 | 18.2 | 1.7 | 15.0 | 1.8 | 13.0 |
| " | 3 " | 25.0 | 6.1 | 3.5 | 11.6 | 21.7 | 2.0 | 17.6 | 1.7 | 14.6 | 1.6 | 12.7 |
| " | 4 " | 25.5 | 6.9 | 3.4 | 11.5 | 21.8 | 1.7 | 17.7 | 1.7 | 14.7 | 1.7 | 12.7 |
| " | 5 " | 25.7 | 6.8 | 3.5 | 11.2 | 22.2 | 1.5 | 17.7 | 1.4 | 14.7 | 1.5 | 12.6 |
| " | 6 " | 23.7 | 7.2 | 4.8 | 11.8 | 23.0 | 2.5 | 18.7 | 2.2 | 15.8 | 2 5 | 13.5 |
| " | 7 " | 25.5 | 7.6 | 4.0 | 11.3 | 22.5 | 2.2 | 18.4 | 2.0 | 15.5 | 2.0 | 13.5 |
| " | 8 " | 25.8 | 7.0 | 3.5 | 11.3 | 22.0 | 1.5 | 17.5 | 1.5 | 14.9 | 1.7 | 13.0 |
| " | 9 " | 26.2 | 7.0 | 4.0 | 11.6 | 22.7 | 2.2 | 18.2 | 1.5 | 15.3 | 1.5 | 13.2 |
| " | 10 " | 25.5 | 7.5 | 4.5 | 11.3 | 23.6 | 2.8 | 18.7 | 2.7 | 15.3 | 2.8 | 13.9 |
| " | 11 " | 26.0 | 7.1 | 4.1 | 9.9 | 22.7 | 2.0 | 18.2 | 2.0 | 15.3 | 2.0 | 13.3 |
| " | 12 M.N. | 25.0 | 7.2 | 4.0 | 10.5 | 23.1 | 2.5 | 18.6 | 2.3 | 15.7 | 2.4 | 13.4 |
| Dec. 11.. | 1 A.M. | 25.7 | 7.8 | 3.2 | 10.1 | 22.6 | 1.8 | 18.0 | 1.4 | 15.0 | 1.4 | 13.1 |
| " | 2 " | 25.8 | 7.2 | 4.1 | 11.0 | 23.0 | 2.0 | 18.3 | 2.0 | 15.5 | 2.0 | 13.3 |
| " | 3 " | 26.1 | 7.2 | 3.6 | 10.5 | 23.0 | 2.1 | 18.8 | 2.0 | 15.6 | 2.0 | 13.6 |
| " | 4 " | 25.1 | 6.9 | 3.5 | 10.2 | 22.5 | 2.0 | 18.0 | 2.0 | 15.0 | 2.0 | 13.1 |
| " | 5 " | 26.0 | 6.7 | 3.0 | 10.5 | 22.4 | 1.7 | 18.0 | 1.8 | 15.0 | 1.8 | 13.1 |
| " | 6 " | 25.5 | 6.8 | 3.5 | 11.0 | 22.3 | 2.0 | 18.0 | 2.0 | 15.0 | 2.0 | 13.0 |
| " | 7 " | 25.7 | 7.0 | 3.8 | 11.3 | 22.8 | 2.0 | 18.0 | 2.0 | 15.0 | 2.0 | 13 0 |
| " | 8 " | 25.5 | 6.8 | 3.2 | 10.2 | 22.0 | 1.8 | 17.6 | 1.7 | 14.8 | 1.7 | 12.9 |
| " | 9 " | 25.8 | 6.7 | 3.6 | 11.0 | 22 2 | 2.1 | 17.8 | 1.8 | 15.0 | 1.9 | 13.0 |
| " | 10 " | 25.9 | 7.0 | 3.8 | 10.9 | 21.2 | 2.0 | 17.3 | 1.9 | 14.7 | 1.9 | 13.0 |
| " | 11 " | 26.0 | 7.0 | 3.5 | 10.9 | 23.0 | 2.5 | 18.1 | 1.7 | 15.0 | 1.7 | 13.0 |
| " | 12 M. | 25.3 | 7.1 | 3.7 | 11.4 | 23.0 | 2.2 | 18.5 | 2.2 | 15.5 | 2.2 | 13.4 |
| " | 1 P.M. | 26.0 | 7.0 | 3.4 | 11.6 | 22.5 | 2.5 | 18.0 | 1.8 | 15.0 | 1.8 | 13.0 |
| " | 2 " | 26.4 | 6.9 | 3.3 | 10.9 | 23.0 | 2.6 | 18.0 | 1.7 | 15.2 | 1.7 | 13.2 |
| " | 3 " | 26.4 | 6.8 | 3.5 | 11.2 | 23.0 | 2.8 | 18.0 | 1.8 | 15.0 | 1.9 | 13.0 |
| " | 4 " | 26.8 | 7.3 | 3.4 | 11.8 | 23.0 | 2.7 | 18.0 | 1.9 | 15.3 | 2.0 | 13.4 |
| " | 5 " | 26.0 | 7.0 | 3.8 | 11.0 | 22.2 | 2.5 | 17.8 | 1.8 | 14.7 | 1.9 | 12.9 |
| " | 6 " | 25.6 | 7.0 | 3.4 | 10.4 | 22.5 | 2.5 | 17.5 | 1.9 | 14.7 | 1.9 | 12.9 |
| " | 7 " | 25.7 | 7.0 | 3.5 | 11.3 | 23.0 | 2.9 | 18.0 | 2.0 | 15.0 | 1.9 | 13.2 |
| " | 8 " | 25.5 | 7.0 | 3.5 | 10.5 | 22 1 | 2.2 | 17.5 | 1.6 | 14.6 | 1.7 | 12.0 |
| " | 9 " | 26.2 | 7.0 | 3.4 | 11.7 | 23.0 | 2.2 | 18.0 | 1.7 | 15.2 | 1.7 | 13.2 |
| " | 10 " | 25.7 | 6.9 | 3.6 | 11.6 | 23.0 | 2.5 | 18.1 | 1.8 | 15.0 | 1.9 | 13.0 |
| " | 11 " | 24.9 | 7.2 | 3.0 | 10.7 | 22.6 | 2.2 | 17.9 | 1.8 | 15.0 | 1.8 | 13.0 |
| " | 12 M.N. | 26.2 | 7.2 | 3.6 | 10.7 | 23.0 | 2.2 | 18.2 | 1.6 | 15.4 | 1.7 | 13.2 |
| Dec. 12.. | 1 A.M. | 26.1 | 7.0 | 3.4 | 10.5 | 23.0 | 2.2 | 18.0 | 1.5 | 15.2 | 1.6 | 13.2 |
| " | 2 " | 26.0 | 7.2 | 3.3 | 10.0 | 22.5 | 2.0 | 17.8 | 1.5 | 15.0 | 1.6 | 13.1 |
| " | 3 " | 26.1 | 7.0 | 3.5 | 10.2 | 23.0 | 2.1 | 18.1 | 1.6 | 15.2 | 1.7 | 13.2 |
| " | 4 " | 26.0 | 6.9 | 3.0 | 10.2 | 22.5 | 2.2 | 17.5 | 1.5 | 15.0 | 1.6 | 12.9 |
| " | 5 " | 26.7 | 7.0 | 3.3 | 10.5 | 22.7 | 1.9 | 18.0 | 1.5 | 15.0 | 1.5 | 13.0 |
| " | 6 " | 27.0 | 7.2 | 3.5 | 10.2 | 23.0 | 2.2 | 18.2 | 1.7 | 15.4 | 1 8 | 18.4 |
| " | 7 " | 26.2 | 6.5 | 2.9 | 11.0 | 22.8 | 2.1 | 18.0 | 1.7 | 15.1 | 1.7 | 13.0 |
| " | 8 " | 26.3 | 7.3 | 3.3 | 10.7 | 23.0 | 2.2 | 18.0 | 1.7 | 15.1 | 1.8 | 13 2 |
| " | 9 " | 26.5 | 7.0 | 3.1 | 11.2 | 22.5 | 2.4 | 17.8 | 1.7 | 15.0 | 1.8 | 13.0 |
| " | 10 " | 26.5 | 7.1 | 3.4 | 10.8 | 23.0 | 2.2 | 18.0 | 1.7 | 15.0 | 1.8 | 13.0 |
| " | 11 " | 26.0 | 6.8 | 3.2 | 10.8 | 22.4 | 2.2 | 17.7 | 1.7 | 14.7 | 1.7 | 13.0 |
| " | 12 M. | 26.2 | 6.6 | 3.6 | 11.2 | 22.7 | 2.6 | 17.7 | 1.7 | 15.0 | 1.8 | 12.8 |
| " | 1 P.M. | 26.5 | 7.0 | 3.7 | 10.9 | 23.0 | 2.4 | 18.0 | 1.8 | 15.1 | 2.0 | 13.1 |
| " | 2 " | 26.0 | 6.7 | 3.3 | 11.0 | 22.7 | 2.5 | 17.9 | 1.8 | 15.0 | 2.0 | 13. |
| " | 3 " | 26.7 | 6.7 | 3.2 | 11.0 | 23.0 | 2.1 | 18.0 | 1.5 | 15.1 | 1.7 | 13.1 |
| Average. ......... | | 25.8 | 6.9 | 3.5 | 11.1 | 22.6 | 2.2 | 17.9 | 1.8 | 15.1 | 1.8 | 13. |

E—TOP.

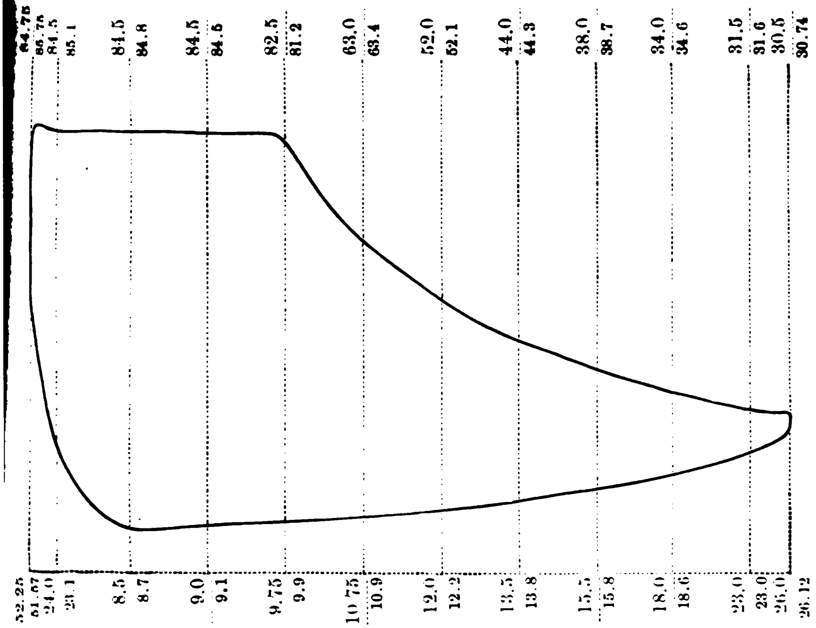
| 0.45. | At 0.55. | | At 0.65. | | At 0.75. | | At 0.85. | | At 0.95. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Subtractive. | | Subtractive. | | Subtractive. | | Subtractive. | | Subtractive. | | Subtractive. | Net Average. |
| 14. | 15. | 16. | 17. | 18. | 19. | 20. | 21. | 22. | 23. | 24. | 25. |
| 2.0 | 9.7 | 2.1 | 8.9 | 2.1 | 8.1 | 2.2 | 7.7 | 2.2 | 6.9 | 2.2 | 98.05 |
| 1.6 | 9.5 | 1.7 | 8.7 | 1.8 | 8.0 | 1.8 | 7.4 | 1.8 | 6.7 | 2.0 | 9.99 |
| 2.2 | 11.2 | 2.5 | 10.2 | 2.6 | 9.7 | 2.9 | 9.0 | 3.2 | 8.2 | 3.9 | 10.64 |
| 2.0 | 10.2 | 2.1 | 9.2 | 2.2 | 8.7 | 2.5 | 8.0 | 2.6 | 7.5 | 3.2 | 10.19 |
| 2.3 | 10.5 | 2.4 | 9.5 | 2.4 | 8.8 | 2.6 | 8.1 | 3.0 | 7.5 | 3.6 | 10.06 |
| 1.8 | 10.0 | 1.8 | 8.9 | 1.9 | 8.2 | 2.0 | 7.7 | 2.3 | 7.0 | 2.8 | 10.16 |
| 1.7 | 9.8 | 1.7 | 8.8 | 2.0 | 8.1 | 2.1 | 7.5 | 2.5 | 6.9 | 3.1 | 9.86 |
| 1.7 | 10.0 | 1.9 | 9.0 | 2.0 | 8.2 | 2.1 | 7.8 | 2.2 | 7.1 | 3.0 | 10.02 |
| 1.6 | 9.9 | 1.7 | 9.0 | 1.8 | 8.1 | 2.0 | 7.5 | 2.3 | 7.0 | 2.9 | 10.17 |
| 2.5 | 10.7 | 2.5 | 9.8 | 2.5 | 9.0 | 2.7 | 8.5 | 3.0 | 7.6 | 3.5 | 10.24 |
| 2.2 | 10.8 | 2.2 | 9.9 | 2.5 | 9.2 | 2.7 | 8.5 | 3.0 | 8.0 | 3.7 | 9.36 |
| 1.7 | 10.1 | 1.9 | 9.5 | 2.0 | 8.7 | 2.5 | 8.0 | 2.7 | 7.4 | 3.1 | 10.20 |
| 1.7 | 10.5 | 2.0 | 9.4 | 2.0 | 8.7 | 2.2 | 8.2 | 2.7 | 7.5 | 2.2 | 10.56 |
| 2.9 | 11.0 | 2.9 | 10.0 | 3.0 | 9.2 | 3.2 | 8.6 | 3.4 | 7.8 | 4.0 | 10.01 |
| 2.0 | 10.6 | 2.1 | 9.7 | 2.2 | 9.0 | 2.4 | 8.3 | 3.0 | 7.9 | 3.9 | 10.34 |
| 2.5 | 10.9 | 2.5 | 9.8 | 2.6 | 9.0 | 2.6 | 8.4 | 3.0 | 7.8 | 3.7 | 10.21 |
| 1.7 | 10.1 | 1.7 | 9.0 | 1.7 | 8.4 | 2.0 | 8.0 | 2.1 | 7.2 | 3.0 | 10.45 |
| 2.2 | 10.6 | 2.2 | 9.6 | 2.3 | 8.8 | 2.7 | 8.1 | 2.8 | 7.6 | 3.6 | 10.28 |
| 2.0 | 10.4 | 2.0 | 9.6 | 2.0 | 8.9 | 2.4 | 8.2 | 2.7 | 7.6 | 3.4 | 10.50 |
| 2.1 | 10.3 | 2.2 | 9.4 | 2.2 | 8.5 | 2.4 | 7.9 | 2.8 | 7.1 | 3.2 | 10.03 |
| 1.8 | 10.3 | 1.8 | 9.2 | 2.0 | 8.4 | 2.0 | 7.7 | 2.2 | 7.0 | 3.0 | 10.29 |
| 2.0 | 10.1 | 2.1 | 9.1 | 2.1 | 8.4 | 2.4 | 7.9 | 3.0 | 7.1 | 3.4 | 9.95 |
| 2.1 | 10.2 | 2.1 | 9.2 | 2.1 | 8.7 | 2.5 | 8.0 | 2.8 | 7.4 | 3.2 | 10.13 |
| 1.9 | 10.0 | 1.9 | 9.1 | 2.0 | 8.2 | 2.1 | 7.7 | 2.6 | 7.0 | 3.2 | 9.98 |
| 2.0 | 10.2 | 2.0 | 9.5 | 2.1 | 8.7 | 2.6 | 8.0 | 3.0 | 7.1 | 3.5 | 10.01 |
| 2.0 | 10.3 | 2.0 | 9.4 | 2.0 | 8.9 | 2.5 | 8.3 | 3.0 | 7.7 | 3.7 | 9.95 |
| 1.7 | 10.5 | 2.0 | 9.4 | 2.1 | 8.7 | 2.2 | 8.0 | 2.7 | 7.5 | 3.5 | 10.28 |
| 2.2 | 10.5 | 2.2 | 9.6 | 2.3 | 9.0 | 2.5 | 8 5 | 3.0 | 7.6 | 3.5 | 10.26 |
| 2.1 | 10.3 | 2.2 | 9 3 | 2.2 | 8.8 | 2.4 | 8.0 | 2.6 | 7.5 | 3.2 | 10.11 |
| 2.0 | 10.3 | 2.1 | 9.4 | 2.2 | 8.6 | 2.3 | 8.0 | 2.6 | 7.3 | 3.4 | 10.22 |
| 2.0 | 10.1 | 2.0 | 9.3 | 2.2 | 8.5 | 2.4 | 8.0 | 2.8 | 7.2 | 3.0 | 10.07 |
| 2.2 | 10.7 | 2.2 | 9.7 | 2.5 | 9.0 | 2.5 | 8.1 | 2.8 | 7.3 | 3.0 | 10.26 |
| 2.0 | 10.1 | 2.1 | 9.2 | 2.2 | 8.5 | 2.5 | 8.0 | 2.8 | 7.1 | 3.1 | 9.89 |
| 2.0 | 10.1 | 2.1 | 9.2 | 2.2 | 8.6 | 2.6 | 8.0 | 2.8 | 7.2 | 3.4 | 9.86 |
| 2.0 | 10.5 | 2.0 | 9.5 | 2.2 | 8.8 | 2.3 | 8.0 | 2.6 | 7.4 | 3.0 | 10.21 |
| 1.9 | 10.2 | 2.1 | 9.1 | 2.2 | 8.4 | 2.3 | 8.0 | 2.8 | 7.2 | 3.1 | 9.84 |
| 2.0 | 10.5 | 2.0 | 9.4 | 2.0 | 8.5 | 2.2 | 8.1 | 2.5 | 7.3 | 3.0 | 10.37 |
| 2.2 | 10.5 | 2.2 | 9.5 | 2.2 | 8.7 | 2.2 | 8.0 | 2.2 | 7.3 | 3.0 | 10.22 |
| 2.0 | 10.4 | 2.1 | 9.3 | 2.2 | 8.7 | 2.5 | 8.0 | 2.5 | 7.2 | 3.2 | 10.13 |
| 2.0 | 10.7 | 2.1 | 9.7 | 2.1 | 9.0 | 2.4 | 8.4 | 2.9 | 7.7 | 3.5 | 10.49 |
| 1.8 | 10.6 | 2.0 | 9.5 | 2.0 | 8.7 | 2.2 | 8.1 | 2.5 | 7.3 | 3.1 | 10.43 |
| 1.8 | 10.5 | 2.0 | 9.5 | 2.0 | 8.7 | 2.4 | 8.0 | 2.7 | 7.7 | 3.5 | 10.30 |
| 1.9 | 10.5 | 2.0 | 9.6 | 2.1 | 8.9 | 2.2 | 8.1 | 2.5 | 7.5 | 3.2 | 10.47 |
| 1.9 | 10.1 | 1.9 | 9.2 | 2.0 | 8.5 | 2.1 | 7.9 | 2.5 | 7.0 | 3.0 | 10.16 |
| 1.7 | 10.2 | 1.8 | 9.2 | 2.0 | 8.7 | 2.1 | 8.0 | 2.5 | 7.2 | 3.0 | 10.39 |
| 2.0 | 10.7 | 2.1 | 9.7 | 2.2 | 9.0 | 2.3 | 8.3 | 2.7 | 7.5 | 3.2 | 10.50 |
| 1.8 | 10.1 | 1.8 | 9.1 | 1.9 | 8.2 | 1.9 | 7.5 | 2.0 | 6.8 | 2.5 | 10.29 |
| 2.0 | 10.5 | 2.0 | 9.5 | 2.2 | 8.9 | 2.4 | 8.1 | 2.7 | 7.4 | 3.0 | 10.34 |
| 2.0 | 10.2 | 2.0 | 9.2 | 2.2 | 8.7 | 2.5 | 8.0 | 2.6 | 7.2 | 3.0 | 10.10 |
| 2.0 | 10.2 | 2.0 | 9.5 | 2.1 | 8.7 | 2.5 | 8.1 | 2.8 | 7.5 | 3.5 | 10.22 |
| 1.9 | 10.1 | 2.0 | 9.2 | 2.1 | 8.5 | 2.2 | 8.0 | 2.5 | 7.0 | 3.0 | 10.07 |
| 1.9 | 10.2 | 2.0 | 9.0 | 2.0 | 8.2 | 2.0 | 7.9 | 2.5 | 7.0 | 3.0 | 10.05 |
| 2.0 | 10.5 | 2.1 | 9.5 | 2.2 | 8.7 | 2.3 | 8.0 | 2.6 | 7.2 | 3.2 | 10.20 |
| 2.0 | 10.4 | 2.2 | 9.4 | 2.2 | 8.6 | 2.4 | 8.0 | 2.5 | 7.2 | 3.1 | 10.12 |
| 1.8 | 10 5 | 1.9 | 9.4 | 2.0 | 8.7 | 2.2 | 8.0 | 2.5 | 7.2 | 3.0 | 10.41 |
| 1.9 | 10.3 | 2.0 | 9.3 | 2.1 | 8.6 | 2.3 | 8.0 | 2.6 | 7.3 | 3.1 | 10.18 |

# TABLE V.

| Date. | Time. | Counter. | Av. Pressure, High Cylinder. | Av. Pressure, Low Cylinder. | Total Coal. | Total Water. |
|---|---|---|---|---|---|---|
| | | | lbs. | lbs. | lbs. | lbs. |
| Dec. 10....... | 11 A.M. | 242,646 | 44.825 | 11.28 | 320 | 200 |
| .. | 12 M. | 243,725 | 43.635 | 10.88 | 765 | 2,580 |
| .. | 1 P.M. | 244.830 | 44.18 | 10.665 | 997 | 5.020 |
| .. | 2 .. | 245.933 | 44.26 | 10.775 | 1,213 | 7,880 |
| .. | 3 .. | 247,038 | 44.12 | 10.435 | 1,468 | 10,600 |
| .. | 4 .. | 248,138 | 43.93 | 10.80 | 1,663 | 12,890 |
| .. | 5 .. | 249.239 | 43.63 | 10.805 | 1,886 | 15,480 |
| .. | 6 .. | 250,341 | 44.81 | 10.87 | 2,115 | 17,980 |
| .. | 7 .. | 251.447 | 42.83 | 10.365 | 2,362 | 20,880 |
| .. | 8 .. | 252.547 | 44.88 | 10.83 | 2.659 | 24,160 |
| .. | 9 .. | 253,650 | 44.69 | 11.075 | 2,878 | 26.140 |
| .. | 10 .. | 254.752 | 44.175 | 10.92 | 3,088 | 28.510 |
| .. | 11 .. | 255,857 | 44.32 | 11.045 | 3,288 | 30,900 |
| .. | 12 M.N. | 256.961 | 44.59 | 11.02 | 3,460 | 33.425 |
| Dec. 11..... .. | 1 A.M. | 258,065 | 44.825 | 11.02 | 3.914 | 35.890 |
| .. | 2 .. | 259.168 | 44.21 | 10.795 | 4.248 | 37.940 |
| .. | 3 .. | 260.270 | 45.075 | 10.92 | 4,500 | 40,920 |
| .. | 4 .. | 261.375 | 44.585 | 10.705 | 4.750 | 43,600 |
| .. | 5 .. | 262.477 | 43.885 | 10.84 | 5,000 | 46,075 |
| .. | 6 .. | 263.584 | 45.195 | 10.735 | 5.370 | 47,920 |
| .. | 7 .. | 264,688 | 44.52 | 10.85 | 5.740 | 50,180 |
| .. | 8 .. | 265.791 | 44.455 | 10.705 | 6.172 | 53.180 |
| .. | 9 .. | 266,894 | 44.58 | 10.59 | 6,518 | 55,630 |
| .. | 10 .. | 267.998 | 45.295 | 10.61 | 6,943 | 58,350 |
| .. | 11 .. | 269,099 | 44.685 | 10.83 | 7.395 | 60.100 |
| .. | 12 M. | 270.201 | 44.56 | 10.89 | 7.670 | 62,820 |
| .. | 1 P.M. | 271 307 | 44 .55 | 10.735 | 7.960 | 65.440 |
| .. | 2 .. | 272,412 | 44.995 | 10.80 | 8,313 | 67,600 |
| .. | 3 .. | 273.517 | 44.39 | 10.695 | 8,590 | 76,625 |
| .. | 4 .. | 274.622 | 44.385 | 11.00 | 9,008 | 73,680 |
| .. | 5 .. | 275,727 | 45.355 | 10.74 | 9.330 | 75,800 |
| .. | 6 .. | 276,831 | 44.43 | 10.53 | 9,600 | 78,170 |
| .. | 7 .. | 277.932 | 44.63 | 10.83 | 9,880 | 80,730 |
| .. | 8 .. | 279,035 | 44.585 | 10.705 | 10,175 | 83,750 |
| .. | 9 .. | 280,139 | 44.81 | 11.13 | 10,425 | 86,330 |
| .. | 10 .. | 281.240 | 44.485 | 11.115 | 10,760 | 88,740 |
| .. | 11 .. | 282.344 | 44.44 | 10.965 | 11,064 | 91.150 |
| .. | 12 M.N. | 283,448 | 45.075 | 11.17 | 11,390 | 92.850 |
| Dec. 12 ...... | 1 A.M. | 284,551 | 44.87 | 11.185 | 11,660 | 95.740 |
| .. | 2 .. | 285,655 | 44.255 | 10.935 | 11.955 | 97.650 |
| .. | 3 .. | 286,760 | 44.655 | 11.15 | 12.250 | 100,670 |
| .. | 4 .. | 287,866 | 43.755 | 10.895 | 12,570 | 103.040 |
| .. | 5 .. | 288,967 | 45.145 | 11.24 | 12,840 | 105 950 |
| .. | 6 .. | 290,070 | 44.72 | 11.185 | 13,125 | 108 310 |
| .. | 7 .. | 291.073 | 44.945 | 11.035 | 13.460 | 110,230 |
| .. | 8 .. | 292.276 | 44.26 | 11.015 | 13,690 | 112.920 |
| .. | 9 .. | 293,380 | 43.83 | 10.765 | 13,965 | 115,030 |
| .. | 10 .. | 294.481 | 43.385 | 10.79 | 14.225 | 117.840 |
| .. | 11 .. | 295.585 | 44.53 | 10.84 | 14.473 | 120.655 |
| .. | 12 M. | 296.690 | 43.96 | 10.815 | 14,732 | 122,830 |
| .. | 1 P.M. | 297,794 | 44.46 | 10 78 | 14,970 | 124.845 |
| .. | 2 .. | 298 899 | 44.735 | 10.945 | 15 200 | 127.620 |
| .. | 3 .. | 300,003 | 45.14 | 11 98 | 15,480 | 130,240 |
| Average.... | ............... | ............ | 44.519 | 10.872 | .......... | .......... |

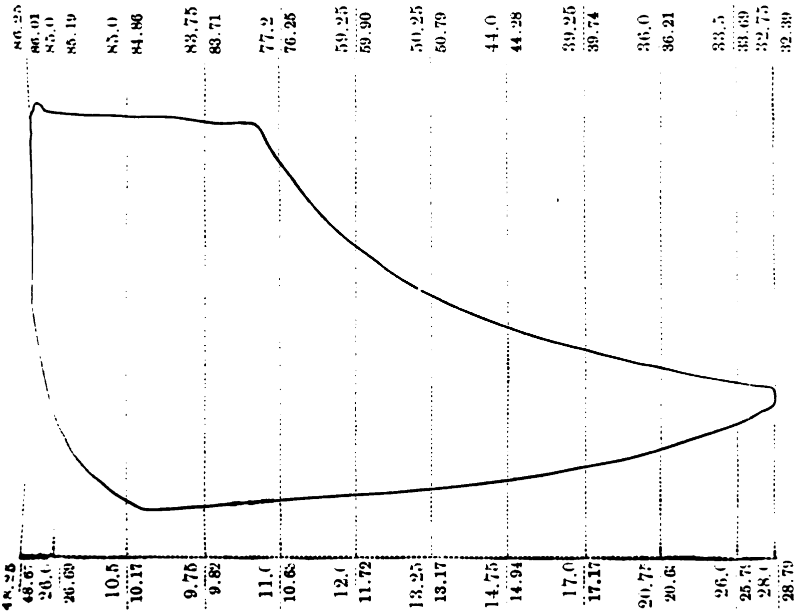
## HIGH PRESSURE CYLINDER—TOP.

DECEMBER 11TH, 6 A. M.



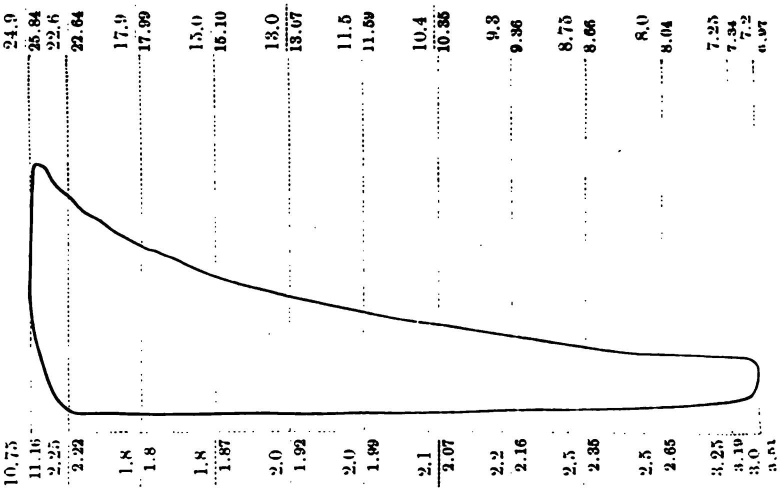
## HIGH PRESSURE CYLINDER—BOTTOM.

DECEMBER 12TH, 3 A. M.



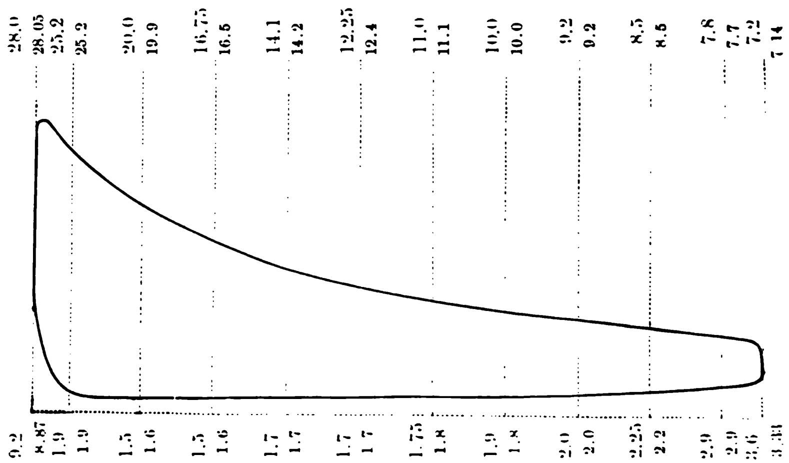
## LOW PRESSURE CYLINDER—
## TOP.

DECEMBER 11TH, 11 P. M.—AND AVERAGES.



## LOW PRESSURE CYLINDER—
## BOTTOM.

DECEMBER 12TH, 2 A. M.—AND AVERAGES.



The cards as given in the cuts, are representations of cards taken by the indicators. The figures to the left of the lines show the pressures as measured by the scales of lbs.—the figures to the right of the lines, the average pressures on the different ordinates taken from the table of indicator cards.

The readings of the barometer at the engine house were—

| | |
|---|---|
| 9 A.M., December 10th | 30.10 inches. |
| 5 " " 11th | 30.30 " |
| 3 P.M. " 12th | 29.68 " |

with nearly a gradual rise and fall.

The records at the signal station, Boston, were—

| | |
|---|---|
| 7.58 A.M., December 10th | 30.070 |
| 7 " " 11th | 30.276 |
| 2 P.M. " 12th | 29.658 |

Records of gauge—

| | Extremes. | Average. |
|---|---|---|
| Vacuum | 27¾ to 28¼ in. | 28 in. |
| Steam gauge in engine room | 65 to 72 lbs. | 90½ lbs. |
| (Corrected.) | | |
| " on boiler No. 1 | 69½ to 75½ lbs. | 73½ " |
| " " No. 2 | 70 to 76 " | 74 " |
| Water gauge in engine room | 63.6 to 64.6 | 64.20 |

This last gauge was that employed to determine the pressure on the water piston, and it will be seen by reference to our first report that reducing the height of the gauge above the average height of water in the well to lbs., and estimating friction in this lower portion of the main at 1 lb.; the pump piston is credited with a load of 73.41 lbs. per square inch. During the night of December 10–11 and 11–12 a number of cards wer taken by Mr. Hermany from the centre of the pump by a Hopkinson indicator. The average pressure, as shown by the cards taken December 10–11, was 73.66 lbs., and December 11–12, 72.75 lbs., of which the average will be at little less than the load estimated in our calculations of duty.

| | | |
|---|---|---|
| The average length of stroke from the cards, before the cut-off on the high-pressure cylinder was at top | 0.337 | of stroke. |
| At bottom | 0.325 | " |
| The average closing of exhaust was in high-pressure cylinder, top, | 0.858 | " |
| Bottom, | 0.841 | " |
| Low " Top | 0.938 | " |
| Bottom, | 0.940 | " |

840142

# THIRD ANNUAL REPORT

OF THE

G 3131

# PUBLIC WATER BOARD

OF THE

## CITY OF LYNN,

FOR THE YEAR ENDING DEC. 31, 1873.

LYNN:
[illegible]
[illegible]
[illegible]

DUPLICATE EXCHANGE 2 AUG. 1901
AM. SOC. CIVIL ENGINEERS

# THIRD ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD

OF THE

# CITY OF LYNN,

FOR THE YEAR ENDING DECEMBER 31. 1874.

LYNN:
THOS. P. NICHOLS, PRINTER,
No. 24 MARKET STREET.
1875.

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PUBLIC LIBRARY
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ASTOR, LENOX AND
TILDEN FOUNDATIONS
1901

# REPORT OF THE PUBLIC WATER BOARD.

The Public Water Board hereby present to the City Council their report of the condition of the Water Department of the city, and a statement of their official acts and doings for the year closing with December, 1874. Appended will be found the Reports of the Clerk of the Board and of the Superintendent of the Works, which reports we present as a part of our own.

The report of the Clerk furnishes an account of the receipts and expenditures of the department during the year, the number of service pipes supplied, and the increase in the number and variety of fixtures in use. A summary of the total expenditure, an account of the introduction of water, and a statement showing the net cost of the works at the time of making this report, are also presented.

The Superintendent's report states so fully the condition of the several parts of the works as to make unnecessary any statement of our own. The information relating to the sources of supply, the tables showing the rainfall for the year, and the average daily consumption of water for each month in the year, we especially commend to your notice. The record of the pumping engine will also be found interesting, as showing the economy with which its work is performed. The table given in this report (see Table II,) allows a comparison to be made with the record of the pumping engines connected with similar works in other cities, and we are pleased to say that the duty performance of the one connected with our works is still larger than that of any pumping engine in the country, and more than fulfils the promise of its designer.

In our report for the year 1873 we recommended that an adequate compensation be allowed the Superintendent for the exacting and perplexing round of duties he is required to perform. By vote of the Board his salary was increased from $1500 to $2000 a year, and the City Council of last year were asked to confirm our action. As no action was had upon our request, we renew our recommendation, and confidently hope that the salary of this officer, as fixed by the Board, will be allowed. We do not speak too highly of his competency and faithfulness, when we say that his services are as valuable as those of any similar officer in the State, while his compensation is smaller than that of superintendents in cities and towns where the extent of the works, and, consequently, the labor of supervision, is much more limited.

tion we desire to express our thanks ve been employed in the responsible authorized to fill, for the fidelity and evinced in the discharge of their their endeavors to satisfy all reason- ade upon the department.

## SOURCES OF SUPPLY.

ports of the Water Board we have the City Council such facts as tend capacity of our sources of supply, the se in the number of consumers, and , made more apparent with each year's of providing abundantly for all who may come takers.

ws having undergone no change, either in the necessity for securing an additional r from whence it should be obtained, we lly refer you to the discussion of these topics nted in our reports for the past two years. st of these contains a map showing the position the two ponds from which our supply is now , the water-shed which feeds them, and their on to other water sources, the utilizing of which, omplete the water supply of the city, has been estly recommended. On this map is also shown situation of Flax, Sluice and Cedar Ponds, and territory naturally draining into them. The extent of the water-shed belonging to each of these systems is there given, and their comparative value as sources of supply, so far as the quantity of water which can be made available affects the question, can be readily determined. Other questions connected with the one to which your attention is here invited may require careful consideration; but that the sources upon which the city now wholly relies for its supply of water will be found insufficient in a year of drouth, is too apparent to admit of doubt.

The average daily consumption of water for the past year, as shown in Table III of Superintendent's Report, was 1,329,290 gallons, or a total consumption of 485,189,801 gallons. On the first of June, Breed's Pond was full, the depth of water at the dam being eighteen feet two inches, and the newly gathered pond at Birch Brook showed, at the dam, a depth of eleven feet. The quantity of water in store at that date was not less than three hundred million gallons. At the close of the year Breed's Pond was reduced to about five feet, while the water area was not more than fifteen acres; Birch Pond during the same time had fallen to eight feet, and its water surface correspondingly diminished. During the seven months following the date above given, viz: from the first of June to the 31st of December inclusive, all the available rainfall upon the water-shed of these ponds was consumed, the storage in Breed's

was substantially exhausted,
reduced three feet.

nly show the insufficiency of
, when we state that, on Jan. 1,
contained eleven feet of water,
ne feet; and that on Jan. 1, 1875,
duced to five feet, and the latter to
et. Both ponds were, therefore, at
ent of the present year, below the
hey stood a year before, while the rain-
iod, in our city, was about thirty-five
facts conclusively show that the con-
ater for the past year has been not only
available rainfall upon the territory
our ponds, but that the storage of the
ar has been largely drawn upon.

previous reports we have endeavored to
necessity for increasing our water sources,
nsure an ample supply in seasons of drouth;
liability to a short supply has been deemed
ote, even if we were so fortunate as to con-
those whom we addressed that such a contin-
existed, to warrant the expenditure necessary
vide against it. But during the five years since
was brought into the city three of them have
ed to be years of very low rainfall, and our com-
ity has barely escaped the inconvenience and dis-
fort, if nothing worse, of a complete failure of its
**er sources to meet the daily demand upon them.**

If the facts we have heretofore presented, and the deductions drawn from them, have been thought too uncertain in their character to warrant the adoption of measures for ensuring an abundant supply of water in seasons of drouth, the actual demonstration that such necessity exists is not now wanting The fears we have expressed, that in a year of low rainfall our supply would be found insufficient, are now realized. As we can have no assurance that another year of drouth will not follow, or that such economy in using water will be practiced as will make our sources of supply sufficient for all who may wish to become takers, the necessity for adding to them can be no longer questioned.

During the year a corporation known as the Flax Pond Water Company has been organized, under authority granted by the Legislature of the State. The water sources which this corporation were authorized to take and control are Flax, Sluice and Cedar Ponds. This company having submitted propositions to the cities of Boston and Chelsea to furnish those cities from five to eight millions of gallons of water a day, the Engineer of the Cochituate water supply was required "to make such surveys and measurements as may be necessary to ascertain the actual amount of water" these ponds will supply. Similar action was taken by the city of Chelsea. As the refusal of these cities to negotiate with said company leaves these water sources unimproved, and as

citizens have believed that these ponds
fficient capacity to ensure an abundant
our city for many years, their value as de-
by the engineers who conducted these sur-
y be regarded as important. We therefore
l the report of the Engineer of the city of Bos-
the City Council of that city.

## METERS.

s a means of checking the unnecessary consump-
n of water, and to equalize in certain cases the
es charged, the Superintendent, under instructions
om the Board, has set during the year one hundred
water meters. Most of them are attached to the supply pipes of livery stables, manufacturing establishments, and other business places, and were put in operation about the first of October. It was the intention of the Board to charge these classes of consumers, from that date, according to the quantity of water used, as determined by meter measurement; and at the rate named in the established water rates of the city. But frequent observation of the meter registers showed that in some of these establishments bad and leaky fixtures had caused an unexpected waste, and time was required to put them in repair. In others the quantity of water used was a great surprise, and the desire was expressed that the Board would not enforce the rule until the commencement of a new year. A petition was also presented to the

Board, asking that the rates for metered water be reduced thirty-three per cent. That the petition might receive due consideration, and that all parties who were to be affected by the employment of meters might have ample time to arrange their places of business with reference to the greatest economy of water, the old ratings were continued. Three months have therefore been allowed in which to change, if desirable, the manner of supplying these establishments, to repair defective fixtures, and to regulate the consumption. Meter rates will therefore be charged on and after January 1, 1875.

The subject-matter of the petition we have referred to has received the attention of the Board, and, after full consideration of the facts and arguments presented by the petitioners, we recommend a reduction of the rates for measured water to two and a half cents a hundred gallons to all consumers. Should the City Council think this change desirable, or that any modification of existing rates be made, we suggest early action, and that all changes be made to take effect from the commencement of the new year.

Although many of the owners of establishments where meters have been attached were aware that for the first quarter no increase in the assessments would be made, we find that the daily consumption of water in the city is much reduced. For the nine months commencing with January, 1874, the average daily consumption was 1,450,973 gallons, while for the three months ending with December it was but 1,038,087 gallons, — a reduction of 412,886 gallons a day. As during the last three months of the year hand hose are but seldom used, this disparity would naturally be accounted for by that fact, but we find that by comparing the average daily consumption for the last three months with the first three months of the year, the discrepancy is even more noticeable. For the first term in the year our record shows a daily consumption of 1,491,986 gallons, against a daily consumption of 1,038,087 gallons for the last three months, or an excess of 453,899 gallons. It is also to be borne in mind that the quarter showing the smallest consumption is the one when the number of takers was the largest; for during the year 308 services have been supplied, and the number of fixtures in use have been increased 1,288. The only abatement which we think should be made from this apparent saving of water under the meter system, is that arising from the change, in a few instances, from the city supply to private wells, and the greater waste in winter months to prevent freezing. We conclude, therefore, that the employment of meters will, as we predicted a year ago, lessen the consumption without diminishing the receipts.

## RECEIPTS.

The receipts of the department for the past year have been $59,320.80. Of this sum, $5,775.19 was received from charges made for extra amount of service pipe, labor, and other items of income; leaving as the legitimate income of the department $53,545.61.

The increase in cash receipts from the sale of water, as compared with the collections for the year 1873, has been $5,553.00. The amount of uncollected bills is $5,680.00; which sum is $2,286.11 larger than at the date of our last report. This sum, when paid, will increase the income from water rents assessed the past year to $55,831.72, or an increase over the receipts of the previous year of $7,839.11.

## MAINTENANCE.

The expenditure for maintenance was $11,846.07; and the payments of interest, including discount on bonds sold, were $54,390.21; total expenditure for maintenance and interest, $66,236.28. As the amount of water assessments for the year was but $55,831.72, the department shows a deficiency of $10,404.56, as compared with the cost of maintenance and interest on the cost of the works.

## CONSTRUCTION.

The construction account has been increased during the year $84,113.77. The several items for which this sum was expended are given in the Clerk's report, a more detailed account of which will be found in the report of the City Auditor.

The construction account, at the close of the year, showed a net expenditure, on account of introduction of water, of $926,463.90. All contracts are now closed, and all bills are settled, except for land damages in connection with the flowing of the Birch Pond reservoir, and an unsettled bill for the painting of the pumping engine. The amount which will be required to liquidate these claims will probably not exceed $8,000. The unexpended balance to the credit of the department is $19,571.98, which sum will be amply sufficient to settle all claims and to meet the expense of providing service pipes for the coming year. But if the City Council shall instruct the Board to extend the works by laying new street mains, an appropriation will be necessary. In view of our limited supply of water, and that to increase it will require the greater portion of another year, we respectfully suggest that any further expenditure for the extension of the works be postponed until an additional supply of water is secured.

EDWIN WALDEN,
JACOB M. LEWIS,
JAMES PURINTON,
DAVID H. SWEETSER,
WM. D. POOL.

# REPORT OF THE CLERK.

*To the President of the Public Water Board:*

I have the honor to submit herewith the Annual Report of the Clerk for the year ending Dec. 31, 1874.

The number of services on the first of January, 1874, was 2,755. There have been added this year 308, making a total of 3,063 on the first of January, 1875.

One hundred and sixty-two services have been shut off during the year, and 382 have been turned on; 84 services have been shut off for non-payment, 63 of which have been let on again, leaving 21 still remaining off.

Ninety-four meters have been set this year, making a total of one hundred now set. The rates for metered water is payable at the end of each quarter. In order to make a just comparison with the receipts of last year, the estimated receipts for metered water during the current term should be taken into the account. The estimated receipts from metered water for the balance of this term, together with bills now due, amounts to $5,680. There is due for extra pipe, labor, etc., $715.64. All places supplied with water by the city have been visited during the year.

The total receipts for the year have been as follows:

| | | |
|---|---|---|
| Received for water rates . . . . . . . . | $52,335 78 | |
| Water for streets . . . . . . . . . . . . | 1,038 05 | |
| Water for building . . . . . . . . . . . | 45 78 | |
| Fines . . . . . . . . . . . . . . . . | 126 00 | |
| | | $53,545 61 |
| Extra pipe, labor, etc. . . . . . . . . . | $5,433 23 | |
| Rents . . . . . . . . . . . . . . . | 136 00 | |
| Old iron . . . . . . . . . . . . . . . | 1 75 | |
| Logs . . . . . . . . . . . . . . . . | 159 21 | |
| Horse . . . . . . . . . . . . . . . . | 45 00 | |
| | | 5,775 19 |
| Total receipts for the year 1874 . . . . | | $59,320 80 |

All of which has been paid into the city treasury.

### INCREASE IN RECEIPTS OVER 1873.

| | | |
|---|---|---|
| Received for water . . . . . . . . . . . | $53,545 61 | |
| Received for water in 1873 . . . . . . . | 47,992 61 | |
| Increase in cash receipts in 1874 . . . . | | $5,553 00 |
| Bills due Jan. 1, 1874 . . . . . . . . . | $3,393 89 | |
| Bills due Jan. 1, 1875 . . . . . . . . . | 5,680 00 | |
| Difference to be added to cash receipts . . | | 2,286 11 |
| Total increase over 1873 . . . . . . . . | | $7,839 11 |

## *EXPENDITURES FOR THE YEAR 1874.*

### MAINTENANCE.

| | | |
|---|---|---|
| Salaries and office expenses . . . . . . . . | $3,094 17 | |
| Repairs, labor, materials, tools, etc. . . | 1,950 39 | |
| Pumping, wages, coal, oil, waste, etc. . . | 6,801 51 | |
| Interest account . . . . . . . . . . . | 54,390 21 | |
| | | $66,236 28 |

### CONSTRUCTION.

| | | |
|---|---|---|
| Breed's Pond . . . . . . . . . . . . | $68 75 | |
| Birch Pond, land damages, labor, etc. . | 2,626 77 | |
| Pipe conduit and right of way . . . . . | 43,785 98 | |
| Reservoir and land . . . . . . . . . | 4,929 60 | |
| Engine-house . . . . . . . . . . . . | 818 96 | |
| Engine and boilers . . . . . . . . . . | 6,401 26 | |
| Force main (land) . . . . . . . . . . | 800 00 | |
| Distributing mains, hydrants and gates . | 12,542 01 | |
| Services and mains in courts . . . . . | 8,265 21 | |
| Meters, boxes, covers, etc. . . . . . . | 3,875 23 | |
| | | 84,113 77 |
| | | $150,350 05 |

### CREDIT.

| | |
|---|---|
| By amount of receipts as per account . . | $59,320 80 |
| Net expenditures . . . . . . . . . . . | $91,029 25 |

## TOTAL EXPENDITURES TO JAN. 1, 1875.

| | | |
|---|---|---|
| Breed's Pond, land and buildings . . | $30,305 91 | |
| Birch Pond, land damages, etc. . . . | 26,100 74 | |
| Pipe conduit and right of way . . . . | 43,785 98 | |
| Reservoir and land . . . . . . . . . | 131,482 30 | |
| Engine-house and land . . . . . . . | 55,112 79 | |
| Engines and boilers . . . . . . . . | 63,019 51 | |
| Force main and land . . . . . . . . | 24,614 00 | |
| Distributing mains, hydrants and gates | 450,189 70 | |
| Engineering . . . . . . . . . . . | 8,464 99 | |
| Services and mains in courts . . . . | 87,171 85 | |
| Meters, boxes, covers, etc. . . . . . | 3,875 23 | |
| Maintenance . . . . . . . . . . . | 44,785 13 | |
| Interest . . . . . . . . . . . . . . | 119,618 05 | |
| | | $1,088,526 18 |

CREDIT.

| | | |
|---|---|---|
| Total receipts for 1871 and 1872 . . | $50,189 42 | |
| Total receipts for 1873 . . . . . . . | 52,552 06 | |
| Total receipts for 1874 . . . . . . . | 59,320 80 | |
| | | $162,062 28 |
| Total net expenditure to Jan. 1, 1875 . . | | $926,463 90 |

Respectfully submitted,

DANIEL WALDEN, Clerk.

# STATEMENT,

SHOWING THE NUMBER OF FAMILIES, STORES, MANUFACTORIES, ETC., SUPPLIED WITH WATER.

| | | | |
|---|---|---|---|
| Families | 3,585 | Printing offices | 5 |
| Hand hose | 1,061 | Blacksmith shops | 7 |
| Stores | 198 | Bakeries | 6 |
| Offices | 30 | Fire engine and hose houses | 5 |
| Shoe factories | 124 | Greenhouses | 11 |
| Morocco factories | 14 | Fountains | 12 |
| Boarding-houses | 71 | Public halls | 5 |
| Hotels | 4 | Almshouse | 1 |
| Restaurants | 11 | City Hall | 1 |
| Private stables | 176 | Post Office | 1 |
| Livery stables | 7 | Gas works | 1 |
| Steam engines | 50 | Railroad | 1 |
| Meat markets | 5 | Boilers for heating | 15 |
| Fish markets | 9 | Foundry | 1 |
| School-houses | 27 | Barber shops | 8 |
| Churches | 9 | Motors | 3 |
| Planing mills | 6 | | |

## NUMBER OF FIXTURES.

| | 1873. | 1874. | Increase. |
|---|---|---|---|
| Faucets | 5012 | 6045 | 1033 |
| Bath tubs | 265 | 314 | 49 |
| Water closets | 736 | 847 | 111 |
| Hand hose | 966 | 1061 | 95 |

# OF THE SUPERINTENDENT.

---

*nt of the Public Water Board:*

honor to present herewith the Annual
Superintendent for the year ending
1874.

## PONDS.

season last year a trench was cut,
n Newhall's Brook was turned into
a short distance below the Lantern
in the Spring this year a pipe was laid
g near Walnut Street, and connected
een-inch pipe which connects the pond
-chamber at the engine-house. From
urces about fifty acres of drainage area
o the resources of the pond; the flash-
e waste weir were also increased six
height, thereby increasing the storage
the pond nearly nine millions of gallons.
was very evident that the pond could not
he supply for the city was taken wholly
source, therefore the water from Birch
taken to supply the city in part, through

the month of March, and was used entirely through the month of April, no water being drawn from Breed's Pond during that month. These precautions, with the assistance of copious rains in April, filled Breed's Pond to eighteen feet two and one-half inches above the sill of the gate-house, — six inches higher than ever before; and for a few days, when we were not pumping, there was a slight waste over the flash-boards; a total of about 1,200,000 gallons were thus lost. The pond was kept to its full height till the 14th of June, at which date there was two feet more water in the pond than at the same date last year. The margin of the pond near the dam has been covered with stones to prevent the bank from washing, and it is now in good condition. Work was suspended on Birch Pond the middle of November, last year. As the pond filled up, it was found that the water passed through the road where it crossed the valley, just above the dam, and flowed a small piece of land on the opposite side of the road. After a careful examination, and consultation with competent engineers, it was decided to build an embankment, with loam, against the road on the pond side, and to raise it as high as the top of the dam; which was commenced early in the Spring, and soon completed, and leakage in that direction appears to be entirely stopped. A waste weir of masonry has been built at the end of the dam, with sixteen feet four inches clear opening, the crest of the overflow being thirteen feet

nged for
d one foot
been ex-
oad, and the
r end of the
stones, giving
earance. The
cleaned of all
ong and extreme
s been drawn to
e depth being five
n December 27th.
lower than at same
one inch below high
Pond was eight feet
ember 28th. If the
will need to practice
ater, to prevent failure

## IR.

nnual Report that there
. and the opinion was
ally cease. From care-
rvals through the year, it
tantly decreasing, and is
t wholly confined to that
ve the line of twelve feet.
slope of the bank was

repaired, where it had been washed by the winter rains, and sowed with grass seed, the walk around the top of the embankment evenly graded, and seats placed for the accommodation of visitors. Steps have also been placed for their accommodation, and it is hoped that they will make use of them, and not destroy the slope of the bank by running over it. The road around the reservoir has been graded and finished, and the side of the hill where the road was excavated has been sloped to correspond with the slope of the reservoir bank. A small sum expended in improving the road up the hill would make this one of the most pleasant resorts of which our city can boast.

## PIPES.

The force and distributing mains are in good condition. There have been sixty-nine leaks in pipes and five leaks in gates, which have been repaired by the contractor without expense to the city. Twenty-six leaks in fire hydrants have also been repaired; many of them occurring through use, and from no fault of the contractor, will have to be paid for by the city. Eleven leaks in service pipes, mostly in the lead connections, have been repaired. Two hundred and ninety-six feet of six-inch pipe has been taken up and relaid, on Chestnut Street, on account of cutting down the street. Seven service pipes have been taken up and relaid from the same cause, and seven fire hydrants have been changed on account of alterations in the lines or grade of streets. Five thousand nine hundred and sixty-one and three-fourths feet of distributing mains have been laid this year; two thousand eleven and three-fourths feet of service pipe has been laid in courts as mains; a four-inch blow-off has been connected with the six-inch pipe at the end of Beach Street. A schedule of the pipes laid and gates and hydrants set this year is annexed. One stand pipe for water carts, one stand pipe for fire purposes, one service for drinking fountain, and three hundred and eight services have been put in this year, amounting to 13,497 feet of pipe, making the total length of service pipe laid to December 31, 1874, 130,831 feet, equal to twenty-four miles 4112 feet. Ninety-four meters have been set this year at various manufactories and livery stables, making the total number set in the city one hundred.

## PUMPING.

The new "Leavitt Pumping Engine," after being thoroughly tested for duty and capacity, by a committee of experts, was formally accepted by the Board, in behalf of the city, on the 20th of January, with a proviso that the builders should, at their own cost, alter the steam connections in the cylinder jackets, on account of their liability to leak. In accordance with this proviso, the work was commenced the first of April; the steam connections in the cylinder jackets were changed, the holes for the old connection carefully plugged, an expansion joint fitted in the steam pipe, the cylinders re-covered with asbestos cement and the lagging replaced. All the work has been done in a careful and thorough manner, and up to the present time there has been no indication of leak. No other repairs have been made upon the engine; only slight repairs have been made upon the boilers and feed pump.

During a part of the month of April, while the above alterations were going on, the small duplex pump was brought into use to assist in keeping up a full supply of water to the city from the reservoir. With this exception the total supply for the year has been pumped by the Leavitt engine, which has worked to great satisfaction, giving higher results in duty than any other pumping engine in this country has yet done. It is now very handsomely painted.

After the acceptance of the engine by the Board, Mr. Holmes, (who had been in charge of the duplex pump all the time it had been in use,) was put in charge as engineer. His attentive and careful management of the machine has fully justified the choice of the Board.

The floor of the coal-house has been covered with a heavy coating of concrete, and bins put up for the coal; and the floor to the basement of the engine-house has been covered with a heavy coating of cement.

For full details of the work done by both engines, see Table I.

The duty of pumping engines is computed by some on the total amount of coal consumed, without any deduction for ashes and cinders; others use the total amount of coal consumed, but deduct the ashes and cinders. Some compute the duty on the coal used in pumping only, without any deduction for ashes and cinders, while others use the coal consumed in pumping only, and deduct the ashes and cinders. In order to afford a ready means of comparing the duty given by the Leavitt engine with the duty given by other engines, I have computed it by the four different methods given above. You will please find it annexed in Table II.

## USE OF WATER.

This year, for the first time, we are able to give the quantity of water used, as drawn from the reservoir from day to day. The largest quantity drawn in one day was 1,981,908 gallons, on Monday, July 27. The smallest quantity drawn was 625,545 gallons, on Sunday, December 6, — less than one-third of that drawn July 27. The details of the monthly and yearly average is given in Table III. By an examination of this table you will observe that the quantity of water used depends very much upon the temperature of the weather; the hot weather of Summer, and the cold weather of Winter, both serving to increase the quantity, while the minimum is obtained only in the moderate weather of the Spring and Fall.

The total number of gallons drawn from the reservoir during the year has been 485,189,801, at a cost to the city of $66.246.28. In closing this report I would again respectfully call your attention to the necessity of providing a suitable workshop and yard, where the necessary tools and materials may be kept in readiness for making all needed repairs upon the street mains, gates, hydrants, &c.

Respectfully submitted.

DANIEL WALDEN, *Supt.*

# TABLE I.

## PUMPING RECORD FOR THE YEAR ENDING DECEMBER 31, 1874.

|  | Number of Pumping Days. | Average Pumping time per day. |  | Total Pumping time. |  | Total number of Revolutions per month. | Average Revolutions per minute. | Coal consumed. |  |  |  | Ashes and cinders. | Ashes and cinders. | Number of Gallons pumped allowing 4 per cent. for loss of action in the Pump. | Number of Gallons pumped into the Reservoir per lb. of coal consumed. | Number of Gallons raised 100 feet high per lb. of coal consumed. | Average head against the Pump. | Duty in lbs. of Water raised 1 foot high per 100 lbs. of Coal consumed, calculated on total Coal consumed, no deduction for ashes or cind. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  |  | Raising steam. | Pumping. | Banking. | Total. |  |  |  |  |  |  |  |
| MONTH. | Dys | H. | M. | H. | M. | Revo'ns. | Rev. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | pr.ct | Gallons. | Galls. | Galls. | Feet. | Lbs. |
| January ........ | 23 | 10 | 55 | 251 |  | 270,300 | 17.94 | 17,850 | 67,670 | 6,250 | 91,770 | 15,462 | 16.84 | 50,424,465 | 549 46 | 901.12 | 164. | 78,248,097 |
| February ....... | 20 | 10 | 58 | 219 | 17 | 242,812 | 18 45 | 13,400 | 59,950 | 5,550 | 78,900 | 12,847 | 16.28 | 45,296,578 | 574.10 | 942 39 | 164 15 | 81,826,614 |
| March .......... | 20 | 11 | 03 | 228 | 22 | 255,733 | 18.66 | 13,500 | 61,200 | 5,400 | 80,100 | 11,205 | 13.9 | 47,706,991 | 595.59 | 977.24 | 164 08 | 84,852,803 |
| April (Leavitt). | 7 | 14 | 12 | 99 | 24 | 111,496 | 18.69 | 4,400 | 26,550 | 1,800 | 32,750 | 4,968 | 15.17 | 20,799,578 | 634.50 | 1040.58 | 164. | 90,443,311 |
| April (Duplex). | 15 | 11 | 12 | 168 |  | 705,600 | 70. | 10,000 | 72,350 | 4,200 | 86,550 | 11,400 | 13.08 | 8,467,200 | 102,57 | 152.83 | 149. | 13,305,200 |
| May ...... ..... | 18 | 12 | 23 | 223 |  | 251,500 | 18.88 | 12,500 | 61,250 | 4,500 | 78,250 | 12,212 | 15.6 | 46,917,325 | 599.58 | 976.48 | 163.39 | 85,060,401 |
| June............ | 17 | 11 | 33 | 196 | 25 | 222,442 | 18.87 | 12,500 | 52,050 | 4,200 | 68,750 | 9,140 | 13.3 | 41,496,555 | 603 59 | 989.64 | 163.96 | 85,931,067 |
| July ............ | 21 | 11 | 32 | 242 | 06 | 273,990 | 18-86 | 13,900 | 62,200 | 6,000 | 82,100 | 10 817 | 13 2 | 51,112,834 | 622.56 | 1021.15 | 164 025 | 88,658,427 |
| August ....... . | 16 | 12 | 25 | 199 | 46 | 228,278 | 19.04 | 11,900 | 52,600 | 3,600 | 68,100 | 8,779 | 12.89 | 42,585,261 | 625.33 | 1027.67 | 164.348 | 89,227,953 |
| September .... | 15 | 12 | 56 | 194 | 07 | 222,449 | 19.10 | 12,000 | 50,900 | 3,350 | 66,250 | 8,054 | 12.15 | 41,497,861 | 626.38 | 1026.82 | 163.93 | 89,166,406 |
| October......... | 14 | 11 | 39 | 163 | 06 | 185,411 | 18.95 | 9,700 | 43,850 | 3,600 | 57,150 | 6,838 | 11.96 | 34 588,422 | 605.22 | 989.84 | 163.55 | 85,945,401 |
| November ..... | 11 | 12 | 30 | 137 | 30 | 151,383 | 18.35 | 7,800 | 34,550 | 2.400 | 44,750 | 5,618 | 10.3 | 28,240,498 | 631.00 | 1035.14 | 164.05 | 89,882,202 |
| December ..... | 8 | 15 | 39 | 125 | 15 | 141,698 | 18.85 | 7,200 | 32,550 | 1,200 | 40,950 | 4,456 | 10.9 | 26,433,762 | 645.51 | 1060.25 | 164.25 | 92,055,457 |
| Totals .......... | 205 | 11 | 37 | 2447 | 18 | 2,557,492 |  | 146,650 | 677,670 | 52,050 | 876,370 | 121,796 | 13.9 | 485,567,330 |  |  |  |  |

# TABLE II.

SHOWING THE DUTY OF THE LEAVITT PUMPING ENGINE FOR THE YEAR 1874, WITH THE COST OF PUMPING.

| | | | | Coal consumed. | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number of Pumping Days. | Average Pumping time per day. | | Number of Revolutions. | Raising steam. | Pumping. | Banking. | Total. | Ashes and cinders. | Ashes and cinders. | Number of Gallons pumped allowing 4 per cent. for loss of action in the Pump. | Number of Gallons pumped into the Reservoir per lb. of coal consumed. | Number of Gallons raised 100 feet high per lb. of coal consumed. | Average head against the Pump. | Duty in lbs. of Water raised 1 foot high per 100 lbs. of Coal consumed, calculated on total Coal consumed, no deduction for ashes or cind. | Duty in lbs. of Water raised 1 foot high per 100 lbs. of Coal consumed, calculated on total Coal consumed, deducting ashes and cinders. | Duty on Coal used in Pumping only, no deduction for ashes and cinders. | Duty on Coal used in Pumping only, ashes and cinders deducted. |
| MONTH. | Dys | H. | M. | Revo'ns. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | pr.ct | Gallons. | Galls. | Galls. | Feet. | Lbs. | Lbs. | Lbs. | Lbs. |
| January, | 23 | 10 | 55 | 270,300 | 17,850 | 67,670 | 6,250 | 91,770 | 15,462 | 16.84 | 50,424,465 | 549 46 | 901.12 | 164. | 78,248,097 | 94.130,732 | 106,146,415 | 127,475,482 |
| February, | 20 | 10 | 58 | 242,812 | 13,400 | 59,950 | 5,550 | 78,900 | 12,847 | 16.28 | 45,296,578 | 574.10 | 942 39 | 164 15 | 81,826,614 | 97,740,133 | 107,690,225 | 128,634,342 |
| March, | 20 | 11 | 03 | 255,733 | 13,500 | 61,200 | 5,400 | 80,100 | 11,205 | 13.9 | 47.706,991 | 595.59 | 977.24 | 164 08 | 84,852.803 | 100.106,187 | 111,073,685 | 131,020,807 |
| April, | 7 | 14 | 12 | 111.496 | 4,400 | 26.550 | 1,800 | 32,750 | 4,968 | 15 17 | 20.799,578 | 634.50 | 1040.58 | 164. | 90 443,311 | 106,616,459 | 111,563,783 | 131,510 831 |
| May, | 18 | 12 | 23 | 251,500 | 12,500 | 61,250 | 4,500 | 78,250 | 12,212 | 15.6 | 46,917,325 | 599.58 | 976.48 | 163.39 | 85,060,401 | 100,790,096 | 108,669,002 | 128 732,329 |
| June, | 17 | 11 | 33 | 222,442 | 12,500 | 52,050 | 4,200 | 68,750 | 9,140 | 13 3 | 41,496.555 | 603 59 | 989.64 | 163.96 | 85,931,067 | 99,104,084 | 113,498,452 | 130,898,815 |
| July, | 21 | 11 | 32 | 273.990 | 13,900 | 62,200 | 6,000 | 82,100 | 10 817 | 13 2 | 51,112,834 | 622 56 | 1021.15 | 164 025 | 88,658,427 | 102,120,731 | 117,033,313 | 134,610,601 |
| August, | 16 | 12 | 25 | 228,278 | 11,900 | 52,600 | 3,600 | 68,100 | 8,779 | 12.89 | 42,585,261 | 625.33 | 1027.67 | 164.348 | 89,227,953 | 102,435,806 | 115,524,609 | 132,662,252 |
| September | 15 | 12 | 56 | 222.449 | 12,000 | 50,900 | 3,350 | 66,250 | 8,054 | 12.15 | 41.497,861 | 626 38 | 1026.82 | 163.93 | 89,165,406 | 101,503,788 | 116,053,329 | 132.112,506 |
| October, | 14 | 11 | 39 | 185,411 | 9,700 | 43,850 | 3,600 | 57,150 | 6,838 | 11 96 | 34 588,422 | 605.22 | 989.84 | 163.55 | 85,945,401 | 97,626,404 | 112,241,269 | 127.294.347 |
| November, | 11 | 12 | 30 | 151,383 | 7,800 | 34,550 | 2,400 | 44,750 | 5,618 | 10 3 | 28,240,498 | 631.00 | 1035.14 | 164 05 | 89,882,202 | 102,771,699 | 116,401,219 | 133,110,320 |
| December, | 8 | 15 | 39 | 141,698 | 7,200 | 32,550 | 1,200 | 40,950 | 4,456 | 10.9 | 26,433,762 | 645.51 | 1060.25 | 164 25 | 92,055,457 | 103 295,637 | 115,811,704 | 129,948,325 |
| Total & Av. | 190 | 11 | 59 | 2,557,492 | 136,650 | 605,320 | 47,850 | 789,820 | 110,396 | 13.98 | 477,100,130 | 604.06 | 990 52 | 163 978 | 86,006.312 | 99,980,581 | 112,220,818 | 129,460,306 |

The duty of the Engine has been computed by the different methods, in order to afford a ready means of comparison with other Engines.

| | |
|---|---|
| Coal for starting and Pumping, 402,820 lbs., at $7.50 per net ton, | $1510 57 |
| 339,150 lbs., at $7.40 per net ton, | 1254 85 |
| Coal for banking, 47.850 lbs., at $8.50 per net ton, | 203 36 |
| Coal for heating, 31.080 lbs, at $7.50 per net ton, | 116 55 |
| 23,893 lbs, at $7.40 per net ton, | 88 40 |
| Five cords of wood, at $11 per cord, | 55 00 |
| Lighting, $36 03 Sundries, $18 36 | 54 39 |
| Oil, Waste and Packing, | 190 07 |
| Repairs to Engine, Boilers and Feed Pump, | 247 82 |
| Wages of Engineer, Fireman, and labor, | 1,886 00 |
| | $5,607 01 |
| Cost of raising one million gallons into the Reservoir, | $11 75$\frac{22}{100}$ |
| Cost of raising one million gallons one foot high, | 07$\frac{16}{100}$ |

# TABLE III.

## CONSUMPTION OF WATER FOR THE YEAR ENDING DEC. 31, 1874.

| | Water drawn from Reservoir. | Average consumption per day. | Average daily increase. | Average daily decrease. | Average to each consumer per day. | Rainfall. |
|---|---|---|---|---|---|---|
| Month. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons | Inches. |
| January | 45,004,220 | 1,451,749 | | | 81 | 2.041 |
| February | 44,598,067 | 1,592,788 | 141,039 | | 89 | 3.6 |
| March | 44,676,448 | 1,441,176 | | 151,612 | 80 | 1.46 |
| April | 38,276,966 | 1,275,899 | | 165,277 | 71 | 6.616 |
| May | 39,852,430 | 1,285,562 | 9,663 | | 72 | 3.62 |
| June | 44,032,860 | 1,467,762 | 182,200 | | 82 | 2.834 |
| July | 48,898,812 | 1,577,381 | 109,619 | | 88 | 2.906 |
| August | 43,316,477 | 1,397,306 | | 180,075 | 78 | 4.89 |
| September | 43,106,478 | 1,436,882 | 39,576 | | 80 | 1.68 |
| October | 36,817,932 | 1,187,675 | | 249,207 | 67 | 1.02 |
| November | 27,932,403 | 931,080 | | 256,595 | 52 | 2.55 |
| December | 28,676,708 | 925,055 | | 6,025 | 52 | 1.7 |
| Totals and averages | 485,189,801 | 1,329,290 | | | 74 | 34.917 |

# TABLE IV.

## SHOWING THE HEIGHT OF WATER AT BREED'S POND ABOVE SILL OF GATE-HOUSE FOR EACH WEEK DURING THE YEAR 1874.

| Date. | Feet. | In. | Date. | Feet. | In. | Date. | Feet. | In | Date. | Feet | In. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. 4 | 11 | 1 | April 5 | 13 | 4 | July 5 | 17 | 2 | Oct. 4 | 10 | 11 |
| 11 | 11 | 10 | 12 | 14 | 1½ | 12 | 16 | 9 | 11 | 10 | 3½ |
| 18 | 12 | | 19 | 14 | 10 | 19 | 16 | 4¾ | 18 | 10 | 2½ |
| 25 | 12 | 6¼ | 26 | 16 | 1 | 26 | 15 | 10¼ | 25 | 10 | 2½ |
| Feb. 1 | 12 | 4 | May 3 | 17 | 6 | Aug. 2 | 15 | 4¾ | Nov. 1 | 8 | 10½ |
| 8 | 12 | | 10 | 17 | 6½ | 9 | 15 | 1½ | 8 | 7 | 5 |
| 15 | 11 | 11 | 17 | 17 | 7 | 16 | 14 | 9 | 15 | 7 | 5½ |
| 22 | 12 | 1 | 24 | 18 | 1½ | 23 | 14 | 4 | 22 | 6 | 6 |
| March 1 | 12 | 2½ | 31 | 18 | 1½ | 30 | 13 | 8 | 29 | 6 | 3 |
| 8 | 12 | 8½ | June 7 | 18 | 2¼ | Sept. 6 | 13 | 1 | Dec. 6 | 5 | 9 |
| 15 | 12 | 11 | 14 | 18 | 1¾ | 13 | 12 | 7 | 13 | 5 | 8¼ |
| 22 | 13 | 2½ | 21 | 17 | 8¾ | 20 | 12 | | 20 | 5 | 3½ |
| 29 | 13 | 2½ | 28 | 17 | 7¼ | 27 | 11 | 6 | 27 | 5 | 1¼ |

# TABLE V.

## SHOWING THE AMOUNT OF PIPE LAID IN 1874.

| NAMES OF STREETS. | | | SIZE OF PIPE. | | |
|---|---|---|---|---|---|
| Street. | From | To | 10 In. | 6 Inch. | 4 Inch. |
| Walnut . . . . . | The Spring . . | 18-inch Pipe . . | | 136. | |
| Ann . . . . . . | Stickney . . . . | Charles . . . . | | | 259. |
| Charles . . . . | Commercial . . | Prospect . . . | | | 782.10 |
| Ontario . . . | Ocean . . . . . | | | | 532. |
| Lewis Court . . | Lewis . . . . . | | | | 516.7 |
| Elmore . . . . | Ingalls . . . . | | | | 286. |
| Chestnut . . . . | Western Avenue | Adams . . . . | | 2356. | |
| Highland Avenue | Brownville Ct. . | Adams . . . . | | 686.4 | 5. |
| Warren . . . . | Commercial . . | | | | 287. |
| Beach . . . . . | For Blow-Off . | | | 22. | 22. |
| Adams . . . . . | | | | 14. | |
| Lewis . . . . . | | | 8 | | |
| Prospect . . . . | | | | | 22. |
| Western Avenue | | | | 23. | |
| Lincoln . . . . | | | | | 4. |
| | | | 8 | 3237.4 | 2716.5 |

## AMOUNT OF PIPE LAID IN COURTS IN 1874.

| Name of Court. | Size. | Length. |
|---|---|---|
| Bickford's Court . . . . . . . . . . . . . . . . . . | 1½ 1¼ 1 | 193.9 |
| Chancery Court . . . . . . . . . . . . . . . . . . | 1¼ 1 | 239.5 |
| Mt. Pleasant Place . . . . . . . . . . . . . . . . | 1¼ | 205.11 |
| New Ocean Street . . . . . . . . . . . . . . . . | 1¼ | 396.8 |
| Oneida Court . . . . . . . . . . . . . . . . . | 1¼ 1 | 391.2 |
| Summer Place . . . . . . . . . . . . . . . . . . | 1½ 1 | 185.11 |
| Union Court extension . . . . . . . . . . . . . . | 1¼ 1 | 109.3 |
| Wells Court . . . . . . . . . . . . . . . . . . . | 1¼ 1 | 289.1 |
| | | 2011.2 |

Total amount of pipe laid in 1874, 7972 feet 11 inches, equal to 1 mile 2692 feet 11 inches. Previously laid, 46 miles 3314 feet and 6 inches. Total amount of pipe laid, 48 miles 727 feet and 5 inches.

# TABLE VI.

SHOWING THE NUMBER AND LOCATION OF GATES SET IN 1874.

| Street. | Location. | No. | Size. | [illegible] |
|---|---|---|---|---|
| Ann | 16 feet west of east line of Ann Street.<br>6 inches south of south line of Stickney Street | 1 | 4 | [illegible] 4 |
| Chestnut | 41 feet east of west line of Chestnut Street.<br>1 foot south of north line of Rockland Court. | 1 | 6 | [illegible] 6 |
| Charles | 12 ft. 10 in. south of north line of Charles St.<br>On a line with the west line of Prospect St. | 1 | 4 | [illegible] 4 |
| Charles | 24 feet south of north line of Charles Street.<br>On a line with east line of Commercial St. | 1 | 4 | [illegible] 4 |
| Elmore | 12 feet 8 inches east of west line of Elmore St.<br>1 ft. 10 inches north of north line of Ingalls St. | 1 | 4 | [illegible] 4 |
| Highland Ave. | 2 ft. 10 in. east of west line of Highland Ave.<br>1 foot south of south line of Adams Street | 1 | 6 | [illegible] |
| Lewis Court | 12 feet 4 inches east of west line of Lewis Ct.<br>1 foot north of north line of Lewis Street | 1 | 4 | [illegible] |
| Ontario Court | 11 feet south of north line of Ontario Court.<br>1 foot west of west line of Ocean Street | 1 | 4 | |
| Beach Blow-off | 21 ft. south of south line of Yacht Club House.<br>13 feet east of west line of Beach Street | 1 | 4 | |
| | | 9 | | |
| | Previously set | 302 | | |
| | Total | 311 | | |

# TABLE VII.

SHOWING THE NUMBER AND LOCATION OF HYDRANTS SET IN 1874.

| | | |
|---|---|---|
| 1. | Chestnut Street | opposite Grant Street. |
| 2. | Chestnut Street | 10 feet north from Rockland Court. |
| 3. | Charles Street | 44 feet east from Ann Street. |
| 4. | Highland Avenue | 330 feet south from Adams Street. |
| 5. | Lewis Court | 450 feet north from Lewis Street. |
| 6. | Lincoln Street | 280 feet north from Union Street. |
| 7. | Ontario Court | 310 feet north from Ocean Street. |

| | |
|---|---|
| Hydrants previously set | 349 |
| Hydrants set in 1874 | 7 |
| Total number of hydrants | 356 |

## SCHEDULE OF STOCK AND TOOLS AT SHOP.

### TOOLS.

| | |
|---|---|
| 74 | D handled shovels. |
| 12 | long handled shovels. |
| 79 | picks and handles. |
| 4 | crowbars. |
| 5 | tunnelling bars. |
| 2 | sledge hammers. |
| 9 | striking hammers. |
| 2 | sets drills for ledge. |
| 2 | chains for ledge. |
| 8 | rammers. |
| 2 | paving rammers. |
| 4 | paving hammers. |
| 2 | nail hammers. |
| 2 | trowels. |
| 4 | wheelbarrows. |
| 2 | hoes. |
| 2 | rakes. |
| 5 | axes. |
| 2 | tool boxes |
| 20 | lanterns. |
| 1 | set blocks and fall. |
| 5 | pair rubber boots. |
| 1 | lining machine and set of cones for service pipe |
| 1 | lining bench. |
| 1 | drill stock and set of drills complete. |
| 4 | cold chisels. |
| 4 | soldering irons. |
| 2 | soldering furnaces. |
| 1 | S wrench. |
| 3 | monkey wrenches. |
| 7 | pails. |
| 1 | pipe bench. |
| 3 | pipe vise. |
| 3 | pipe cutters. |
| 2 | die stocks. |
| 2 | set dies. |
| 9 | pair pipe tongs. |
| 1 | spirit level. |
| 3 | handsaws. |
| 1 | draw knife. |
| 1 | grindstone. |
| 1 | stove and pipe. |
| 1 | melting furnace. |
| 1 | solder pot. |
| 1 | solder mould. |
| 1 | measuring tape. |
| 1 | hatchet. |
| 1 | breast drill. |
| 1 | branding iron. |
| 1 | force pump and pipe for thawing out pipe. |
| 6 | oil cans. |
| 2 | gate keys. |
| 2 | service keys. |
| 2 | hydrant wrenches. |
| 2 | horses. |
| 1 | heavy wagon and harness. |
| 1 | light wagon and harness. |
| 1 | pung. |
| 1 | hand cart. |

### STOCK AND FITTINGS.

| | |
|---|---|
| 338 | feet 2-inch pipe. |
| 35 | feet 1½-inch pipe. |
| 837 | feet 1¼-inch pipe. |
| 423 | feet 1-inch pipe. |
| 388 | feet ¾-inch pipe. |
| 91 | corporation stops, assorted. |
| 111 | stop and waste stops asst. |
| 955 | couplings asst. |
| 29 | bushings asst. |
| 144 | nipples asst. |
| 289 | elbows asst. |
| 550 | T's asst. |
| 107 | caps asst. |
| 136 | plugs asst. |
| 150 | unions asst. |
| 49 | R and L couplings asst. |
| 97 | reducing couplings asst. |
| 19 | connections asst. |
| 1 | 2-inch peet valve. |
| 3 | 1½-inch peet valve. |
| 6 | lbs. tin. |
| 34 | lbs. solder. |
| 10 | lbs. old lead. |
| 1588 | lbs. lead pipe. |
| 8 | meters. |
| 7 | P hydrant cocks. |
| 33 | P hydrant covers. |
| 4 | meter covers and frames. |
| 214 | stop boxes. |
| 15 | stop box covers. |
| 8 | gallons lubricating oil. |
| 18 | gallons asphaltum varnish. |
| 3 | gallons spirits turpentine. |
| 50 | feet rubber hose. |
| 12 | feet rubber packing. |
| 1 | 12-inch gate. |
| 1 | 6-inch gate. |

## FURNITURE AND SUPPLIES AT ENGINE-HOUSE.

1 library table.
4 chairs.
1 clock.
9 brass lamps and brackets.
2 glass lamps and brackets.
2 lanterns.
3 thermometers.
2 indicators.
1 feather duster.
1 dust pan and brush.
1 platform scale.
1 iron wheelbarrow.
2 wood wheelbarrows.
2 sets of fire tools.
2 coal shovels.
5 ladders.
2 pails.
1 bench and vise.
1 ratchet and set of drills.
1 breast drill.
1 set of taps and dies.
2 monkey wrenches.
13 S wrenches.
3 socket wrenches.
2 crowfoot wrenches.
1 hydrant wrench.
4 gate keys.
1 service key.
2 spanners.
2 copper hammers.
1 hatchet.
1 screw driver.
6 cold chisels.
2 steel bars.
1 tallow pot.
1 ladle.
1 coal screen.
1 set of blocks and fall.
2½ lbs. black lead.
25 lbs. cotton waste.
9 lbs. Martin's packing.
30 lbs. Selden's packing.
25 lbs. hemp packing.
12 lbs. rubber packing.
5 oil cans.
1 set of oilers.
38 gallons cylinder oil.
35 gallons lubricating oil.
5 gallons kerosene.
12 tons anthracite coal.
2 tons Cumberland coal.
½ cord slabs.
6 steam valves.
6 pump valves.
3 air pump valves.
½ doz. gauge cocks.
2½ doz. valve springs.
3 unions.
1 No. 1 Blake pump.
87 shovels.
25 spades.
6 scythes.
21 brush hooks.
8 mattocks.
7 picks.
1 12-inch gate.
1 10-inch gate.

# REPORT OF THE BOSTON ENGINEER

ON THE

# FLAX POND WATER SUPPLY.

---

OFFICE OF THE CITY ENGINEER,
*City Hall, Boston, Dec.* 21, 1874.

*To the City Council of Boston:*

In obedience to your order "That the City Engineer be directed to make such surveys and measurements as may be necessary to ascertain the actual amount of water that can be furnished from Flax, Sluice and Cedar Ponds," I have made such surveys and measurements, and now have the honor to present the results.

A careful survey of the water shed of the valley has been made, and its area found to be 2.61 square miles. The area, as computed from a survey made a few years ago for the city of Lynn, is 2.48 square miles. In the survey just completed, nearly one hundred acres of doubtful territory has been included, which probably accounts for the difference of results above shown.

It having been claimed that these ponds are largely fed from springs, having their source outside the apparent water shed, special attention was given to the discovery of their effect, if any, upon the yield of water. The levels of the neighboring water courses and ponds were taken, and the heights of water in the intervening wells were measured, also weir measurements of the flow of water were made at the outlet of Flax Pond, and at a point a little below Cedar Pond.

The data thus obtained show conclusively that there was no appreciable flow into any of the ponds from any other source than the natural water shed.

The natural flow at the outlet of Flax Pond was found to be about 312,000 gallons in twenty-four hours, or 128,400 gallons per square mile of water shed. The same relative flow was found at the weir below Cedar Pond, showing that no springs from a distant source found their way into either Flax or Sluice Ponds. This flow corresponds to the flow usually found in the streams of Eastern Massachusetts in seasons of drought. Thus, the flow of the Sudbury in the early part of November of this year, as determined by accurate gaugings, was 135,000 gallons per square mile of water-shed.

The yield of this valley, then, is to be computed from the area of its water shed, and its capacity for storage. The character of the ground surface, being very steep and rocky, is such as to assure the collection of a large percentage of the rainfall. It is therefore assumed that sixteen inches may be collected in the year of extreme drought, and that twenty inches may be collected in each of a series of eight years of low rainfall.

Allowing for the effect of storage and of evaporation from water surfaces, and computing the yield under the above assumptions, it is found to be about two million gallons in twenty-four hours. The ordinary average daily yield would be about two and one-half millions.

Respectfully submitted.

JOS. P. DAVIS, City Engineer.

840132

# FOURTH ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD

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TILDEN FOUNDATIONS

OF THE

## CITY OF LYNN,

FOR THE YEAR ENDING DECEMBER 31, 1875.

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1901

# CITY OF LYNN.

IN BOARD OF MAYOR AND ALDERMEN,
*December* 31, 1875.

*Ordered,* That the Public Water Board be and they are hereby instructed to present their Annual Report in print to the City Council, as soon as practicable, the same to be in form to accompany the City Documents. The expense to be charged to the account of Printing and Stationery.

Sent down for concurrence.

BENJ. H. JONES, City Clerk.

IN COMMON COUNCIL, *Dec.* 31, 1875.

Adopted in concurrence.

S. HENRY KENT, Clerk.

A true copy. Attest:

CHAS. E. PARSONS, City Clerk.

# Report of the Public Water Board.

The Fourth Annual Report of the Public Water Board, presenting to the City Council a statement of the receipts and expenditures of the Department for the year 1875, with such other information relating to the water supply of the city as seems to the Board important, is hereby submitted.

The Reports of the Clerk of the Board, and of the Superintendent of the Works, in which will be found full and carefully prepared tables showing the rainfall for the year, the consumption of water, duty of pumping engine, and other interesting data, are appended.

## SOURCES OF SUPPLY.

During the past year the quantity of water received into the two storage reservoirs, from which the supply of water to the city is drawn, was not only equal to the requirements of all consumers, but slightly increased the quantity in store at the commencement of the year. The rainfall for the year was but a fraction of an inch less than the assumed average of forty-two inches. The supply to both reservoirs was about five hundred and forty millions of gallons, while the consumption for the year was but four hundred and seventy-one millions; thus showing an excess of supply over the demand of sixty-nine millions of gallons. Excluding from the calculation the rainfall upon the area of the ponds, which in ordinary years is supposed to be equal to the evaporation, we find that about forty-seven per cent. of the total rainfall, upon the area which drains to our reservoirs, was collected and made available for use. As the rainfall for the year was an average one, and the quantity of water in store at the close of the year was increased but sixty-nine million gallons, a quantity only equal to the consumption of the city for a period of six or seven weeks, the necessity for obtaining a further supply of water at an early day seems quite apparent.

The quantity of water received into our storage basins during the year was equal to twenty inches of the total rainfall upon the watershed which feeds them. If by reason of the rainfall falling below the average there should be collected for the coming year but fifteen inches, a quantity as great as can be expected in a very dry year, the supply will be hardly sufficient for the present number of consumers. At the beginning of the year 1875 the quantity in store was quite limited, and as the increase for the year was but sixty-nine millions of gallons, our reservoirs are, at the date of this report, at a low stage. We have, therefore, no considerable amount of water to draw upon, and the supply to the city must mainly depend upon the income to our reservoirs from the rain which falls during the year. If the rainfall for the year should be as low as thirty-five inches (the quantity which fell in 1874), we cannot expect to collect more than fifteen inches, which quantity is but three-fourths of the amount made available last year.

The percentage of rainfall collectable is not to be regarded as a fixed proportion of the quantity which falls in any given year, for it varies as the amount falling is large or small, when the ground is frozen, or is thoroughly saturated by frequent rains. When the rainfall in a year is fifty inches, the per cent. collectable probably does not fall below sixty; but when it is only an average, or forty-two inches, the quantity collectable will hardly reach fifty per cent.; and when the rainfall is but thirty-five inches, not more than fifteen inches can be made available. While, therefore, calculations showing the amount of rainfall, and the quantity which can be made available, are highly valuable, and determine with almost precise accuracy the quantity of water which may be depended upon from any given source, when long periods of time and abundant storage capacity are taken into account, such calculations are of little or no value for any particular year. It is this fact which we wish to make clear, that, having no considerable quantity of water husbanded in our reservoirs, the city will be almost wholly dependent for its supply for the coming year upon the quantity which shall be collected from the rainfall. It is *probable* that the rainfall will be sufficient to furnish the amount required, but the contingency of a low rainfall and consequent low rate of supply may happen, in which case we fear the supply will be found inadequate. The Reports of the Board in previous years have quite fully discussed the question we here present, and the matter is alluded to at the present time to relieve us from any responsibility in case our sources of supply should fail to afford a sufficient quantity to meet the requirements of consumers for the coming year.

## QUALITY OF THE WATER.

The character of the water supplied the past year was not at all times satisfactory. A drouth in winter is quite unusual; but during the winter of 1874–5, owing to the small amount of rain which fell, and the severity of the weather, the supply to our reservoirs was as small as in the summer months. The water supplied to the city was therefore largely drawn from the quantity in store at the close of a very dry season. We were compelled to draw the ponds to a very low point, and to use a body of water which stood, at its highest level, but a few feet from the bed of the reservoirs. On the eighteenth of February last the water in Breed's Pond was but two feet and ten inches at the dam; and in Birch Pond but four feet and ten inches. The water area in Breed's Pond could not have been more than ten acres, or less than one-fifth of the area flowed when the pond is full; while that in Birch Pond may have been equal to a half of the area of a full pond. From the first of

September, 1874, to the first of March, 1875, a period of six months, only thirteen inches of rain fell; and much of this was formed into ice and was not available until the warm weather of March and April unsealed the brooks and it had found its way to our sources of supply.

This condition of our water sources required that for a time the entire supply to the city should be taken from the Birch Pond reservoir; a reservoir which had been built but a year, and contained at that time the first water which had been gathered. A storage basin from which the surface mould, decaying leaves and other vegetable matter capable of decomposition, has not been removed, requires time to allow the water gathered in it to become clear and bright. The necessarily hurried construction of this reservoir, in the fall of 1873, did not allow the time required for the removal of these immediate causes of discoloration, and the water supplied from this source was dark and unsatisfactory.

The low stage of the water, and the diminished area flowed, brought forward to the gate-house an immense number of small fishes which had been developed since the pond was gathered. These covered so completely the gate-screens that for several days the services of two or more men were required to remove them. Only by their removal could the screens be kept sufficiently open for the passage of the water to the supply main which feeds the well chamber at the Engine House, and more than a hundred bucketfuls, but few of them measuring more than four inches in length, were carried away. The employment of small dip-nets for this work disturbed and roiled the water at the precise point where it passes into the pipe-chamber, and where disturbance would do the most harm. Under conditions so unfavorable we were not surprised that the water drawn from this basin was unsatisfactory, and that complaints of its bad appearance and quality should be very generally expressed.

Later in the season, and after the reservoirs had been somewhat replenished, the water in Breed's Pond was found to be affected unfavorably. To a casual observer its appearance denoted no defilement, but upon close examination small particles of suspended greenish matter were detected, which were distributed through the entire body of the water. This condition of the pond was first observed in the month of July, and continued through the two following months. At no time did the water in the pond become so much affected as to be offensive, but when it had been delivered to the pump-well, and lifted to the reservoir for distribution over the city, it smelled and tasted badly. The offensive taste and odor to which we allude is supposed to be imparted to the water by the greenish matter of which we have spoken, which is regarded as a species of aquatic vegetable growth, harmless in character, and usually disappearing " when the first fall in the temperature, or the first brisk breeze, destroys the conditions necessary to maintain this ephemeral life." From many inquiries of those having the care of water supplies, and from engineers who have observed the varying character of water held in reservoirs, whether natural or artificial, we learn that the condition of the water in Breed's Pond, as above described, is not at all peculiar to that source. Nor do we find that the occasion of such temporary defilement is so well understood as to be easily explained. Several of the water sources which have been affected, and which supply other New England cities, we have visited, and have observed the appearance of the water during the period of its defilement. There is great similarity in the appearance and taste of the water, and in the odor emitted, in them all; and in every instance the quantity of water usually held in reserve had been largely drawn upon. Whether the trouble experienced is due to the fact that we have had several dry years and a low rate of supply, while the increased consumption has required the total annual yield in addition to the quantity formerly held in store, and that the water is now brought to the city in the summer months without being improved by long storage, we do not undertake to decide. This, however, is certain, that until Breed's Pond had been drawn low, and the quantity of water held in reserve had been required to meet the demands of consumers, no occasion for complaint had arisen, and, except for the slight discoloration which at times was apparent, the supply was unexceptionable.

## RECEIPTS OF THE DEPARTMENT.

The receipts of the department during the year were

$54,784.47, from which should be deducted $2,231.21, received for service pipe, labor, &c.; leaving as the legitimate income of the department, from water rates assessed, $52,553.26. The total amount of water rates assessed the past year was $53,230.21, and there remained uncollected, at the close of the year, $3,871.58. While the collections for the year were $1,130.10 less than for the previous year, the actual water assessment was reduced but $253.89.

The slight falling off in the amount of assessments above reported did not occur, however, from any reduction in the total number of consumers, but from other causes. First, the rates for metered water were reduced, by action of the City Council, to two and a half cents a hundred gallons to all consumers, which reduced the income from this class $1,702.80; and, secondly, there was abated $2,013.00 to consumers whose supplies were interrupted by the freezing of service pipes. If, then, the rates for metered water had remained unchanged, and there had been no abatements for causes stated, the amount of water rates assessed the past year would have been increased $3,461.81.

Although there were added during the year one hundred and sixty-one new services, the number of families supplied with water was smaller than for the previous year by one hundred and seventeen. This is accounted for by the number of unoccupied tenements to be found in the city, most of which are in tenement blocks, that, when again occupied, will require the water to be turned on. In view of the depressed condition of all our business interests, the receipts of the department have been as large as could be reasonably expected. Such a condition of affairs hinders the erection of many new buildings, and suggests measures of economy which more prosperous periods would not require to be adopted. The classes of consumers which are smaller in number than at the date of our last report are as follows, viz: Families, 117; Private Stables, 24; Engine Boilers, 7; Planing Mills, 3; Fountains, 1. These losses, however, have been more than compensated by the increase in other classes, as the number of fixtures in use have increased during the year seven hundred and five.

## MAINTENANCE.

Our maintenance account for the past year is unusually large, and shows an increase over that of the previous year of $8,036.26; the account standing at $19,882.33, against $11,846.07 for the year 1874. This large increase in expense is mainly due to the severity of the last winter, and to an accident to the pumping engine, which will be found fully explained in the Superintendent's Report. The extremely cold weather of the winter of 1874–5 caused the frost to penetrate the ground to an unusual depth, and many of our service pipes were frozen. The working force employed in thawing out was as large as that engaged in the warmer seasons, when the labor for extending the works and the putting in of new services is done. $4,861.86 was the cost of labor and repairs on service pipes alone ; and for repairs on mains, hydrants and gates, caused by freezing, $1,382.35 ; while for lowering pipe in streets where the grade had been cut down, a further sum was expended, of $1,254.84. The expenditure for labor and material to repair the damage occasioned by frost was not less than $7,000. In addition to the expenses above enumerated an outlay was required at both ponds of $1,600, to remove the tree-stumps and earth lifted by the ice ; and $1,446.00 was expended in repairing an accident to the pumping engine, and for slight repairs on the boilers. As will be seen by the Report of the Clerk of the Board, the ordinary running expenses of the department have not increased, but, on the contrary, the charges for salaries and office expenses, coal, oil, &c., have slightly diminished.

It will be our earnest endeavor to so conduct the department placed under our charge as to realize the greatest economy possible to be practised, and satisfy the reasonable demands of those who contribute towards its support. We are confident that if no unusual accident occurs, and the winter goes by without requiring extraordinary outlay for repairs, the maintenance account will fall even below that of 1874, while the receipts will doubtless be somewhat increased over the amount received last year.

## CONSTRUCTION ACCOUNT.

As will be seen by the Clerk's Report, the construction account has been increased during the past year in the sum of $12,335.15. The purposes to which this sum has been applied will be found stated in detail in the Clerk's Report.

The net expenditure on account of the Water Works of the city, to date, exclusive of all charges on account of deficiencies in earnings to meet interest and maintenance, but inclusive of all items of interest during the time of constructions, is $910,260.04.

The appropriations to meet this expenditure are represented by bonds and notes, issued by authority of the City Council, amounting to $921,500.00, and a transfer of unappropriated funds in the City Treasury to Water Works, amounting to $22,929.34; total appropriation, $944,429.34. Of this sum $34,169.30 has been used to meet payments of interest on indebtedness, as elsewhere set forth. There is therefore no appropriation to the credit of the department.

The total interest-bearing debt is then $921,500.00. Of this amount $525,500.00 bears an interest of six per cent.; 50,000.00 on which seven per cent. is now paid will probably be renewed on the first of July at six per cent., and $350,000.00 will bear seven per cent. interest until July first, 1878. The interest, therefore, on the water debt, for the coming year, will be $59,040.00, which will doubtless be wholly paid from the receipts from water rents. The additional requirement will be for the maintenance account, which may be set down at $12,000.00, and such sum in addition as may be necessary to answer applications for service pipes, which will be small. But whatever sum may be required for these purposes should be provided for in the annual appropriations. To some extent extension of the works will be required in every year, and to us it seems wiser to make an annual appropriation to meet these expenses, than to go on increasing the construction account. Any large outlay, such as will be required to increase our supply of water, or to purchase another pumping engine when needed, will of course be met by a loan; but small expenditures, such as those to which we have alluded, should not be allowed to increase the water debt.

In a city which has the elements of thrift and growth within it, no work of this character can be said ever to be done; no more than that the schools existing to-day will be found sufficient for the future, or that the Fire Department, or police force, will never require additions to be made to their equipment or numbers. And until the income of the department is wholly self-sustaining, and also sufficient to meet the small expenditure which each year will require to answer the applications of new takers, we respectfully suggest that the City Council provide for these wants in the annual appropriations.

## CONCLUSION.

In submitting our Report we desire to make favorable mention of those to whom is committed the immediate charge of the Works. The Superintendent's term of service began with the organization of the Water Department in 1871, and he is now thoroughly familiar with every part of the Works. He fully understands the nature and consequence of any accident likely to occur, and his acquaintance with the many questions which arise in connection with the care and maintenance of water works readily suggests the best methods for an economical management of those placed under his charge. As will appear from an examination of the records, books and accounts of the department, his duties as Clerk of the Board are equally well performed.

The duties of Water Registrar are mainly performed by the obliging and affable Assistant of the Clerk, who, sharing the responsibility for the correctness of all accounts with water-takers, is rightly entitled to the commendation which faithful service elicits from those in whose behalf it is employed.

EDWIN WALDEN,
JAMES PURINTON,
JACOB M. LEWIS,
DAVID H. SWEETSER,
WILLIAM D. POOL.

# Report of the Clerk.

*To the President of the Public Water Board:*

I have the honor to submit herewith the Annual Report of the Clerk of the Board for the year ending December 31st, 1875.

The number of services on the first of January, 1875, was 3,063. There have been added during the year 161, making the total number of services on the first of January, 1876,—3,224.

Three hundred and seventy-seven services have been shut off during the year, and three hundred and seventy-nine have been let on. Two hundred and eleven have been shut off for non-payment of dues; ninety-one of which, all dues and fines having been paid, have been let on again; leaving one hundred and twenty still remaining off.

Seven meters have been set during the year, and five have been discontinued, making an addition of two over last year; the total number of meters now in use being one hundred and two.

On account of the extreme depression in business during the last year, many tenements have been vacated, so that the number of families supplied with water during the year has been one hundred and seventeen less than for the year previous. The outstanding bills now due amount to the sum of $3,871.58. There is also due for extra pipe, labor, &c., the further sum of $376.40.

In the statement of comparative receipts for 1874 and 1875 you will notice a discrepancy in the amount due on the first of January, 1875, with the amount stated to be due in the last Annual Report. The general use of meters for factories was adopted on the first of January, 1875, and, in order to make a just comparison of receipts with the year previous, the estimated receipts for metered water from January 1st to April 1st ($2,485.37) were added to the bills due. The estimated receipts for metered water from January 1st to April 1st, 1876, have not been added to the amount due, therefore it became necessary to deduct that item from the bills due on January 1st, 1875. The amount of $2,013.63, abated from the April payment on account of frozen pipes, was essentially a refunding of that amount on the rates received in October, 1874, and should justly be credited to the receipts of 1875.

In making up the general construction account, the former practice of including the total maintenance and interest accounts has been changed, those items being charged against the income from the works, and the construction account now shows the actual cost of the works from the time the first pipe was laid, in 1869, for fire purposes, to January 1st, 1876.

All places supplied by the city with water have been visited during the year.

The total receipts for the year have been as follows:

| | | |
|---|---|---|
| Water rates | $50,465 12 | |
| Water for streets | 1,806 80 | |
| Water for building | 57 34 | |
| Fines | 182 00 | |
| Rents | 42 00 | |
| | | $52,553.26 |
| Extra pipe, labor, &c. | | 2,231 21 |
| Total receipts | | $54,784.47 |

All of which has been paid into the city treasury.

| | |
|---|---|
| There have been abatements for non-usage of water, on account of the freezing of the water pipes, amounting to | $2,013 36 |
| The receipts have also been diminished by lowering the rates for metered water, in the sum of | 1,702 30 |

## EXPENDITURES FOR THE YEAR 1875.

### MAINTENANCE.

| | | |
|---|---|---|
| Salaries and office expenses, | $3,032 18 | |
| Repairs on services, labor, tools, materials, &c., including thawing out pipes and damage by frost | 4,861 86 | |
| Repairs on mains, hydrants and gates, including damage by frost | 1,382 35 | |
| Lowering pipe on streets where the grade has been altered | 1,254 84 | |
| Labor on Reservoir | 158 00 | |
| Labor on Breed's Pond | 1,006 07 | |
| Labor on Birch Pond | 645 63 | |
| Labor and repairs on Engine House | 214 90 | |
| Repairs on engine and boilers | 1,446 40 | |
| Pumping, wages, coal, oil, waste, &c. | 5,880 10 | |
| | | $19,882 33 |

### CONSTRUCTION.

| | | |
|---|---|---|
| Labor and painting engine | $425 21 | |
| Distributing mains, hydrants and gates | 3,017 21 | |
| Services and court mains | 5,894 09 | |
| Meters | 314 88 | |
| Work Shop and Stable | 1,613 76 | |
| Land at Birch Pond | 1,070 00 | |
| | | $12,335 15 |
| **Total** expenditure | | $32,217 48 |

## *TOTAL EXPENDITURES TO JAN. 1st, 1876.*

| | | |
|---|---|---|
| Breed's Pond, land and buildings | $30,305 91 | |
| Birch Pond, land damages, &c. | 27,170 74 | |
| Pipe conduit, and right of way | 43,785 98 | |
| Reservoir and land | 131,482 30 | |
| Engine House and land | 55,112 79 | |
| Engines and boilers | 63,444 72 | |
| Force main and land | 24,614 00 | |
| Distributing mains, hydrants and gates | 453,206 91 | |
| Engineering | 8,464 99 | |
| Services and court mains | 93,065 94 | |
| Meters, boxes, covers, &c. | 4,190 11 | |
| Work Shop and Stable | 1,613 76 | |
| | | $936,458 15 |

### CREDIT.

| | |
|---|---|
| By amount received for extra pipes, &c. | 26,198 11 |
| Total net expenditure | $910,260 04 |

# STATEMENT

## Of Interest, Cost of Maintenance and Water Receipts, to January 1st, 1876.

| | | |
|---|---|---|
| Total accrued interest to January 1st, 1876 | $181,131 56 | |
| Total cost of maintenance to January 1st, 1876 | 64,667 46 | |
| | | $245,799 02 |

### CREDIT.

| | | |
|---|---|---|
| Total receipts for water to January 1st, 1876 | $190,648 64 | |
| Amount of bills due and uncollected January 1st, 1876 | 3,871 58 | |
| | | $194,520 22 |
| Total deficiency of income to meet interest and maintenance | | $51,278 80 |
| Amount of deficiency charged to construction account | | 34 169 30 |
| Balance of deficiency provided for by City Treasurer | | $17,109 50 |

Respectfully submitted,

DANIEL WALDEN, Clerk.

## STATEMENT,

SHOWING THE AMOUNT OF WATER ASSESSMENTS, THE AMOUNT COLLECTED, THE AMOUNT DUE AND UNCOLLECTED, AND THE INCREASE IN ASSESSMENTS FOR EACH YEAR SINCE RATES WERE ESTABLISHED.

### 1871.

| | | |
|---|---|---|
| Total water rates assessed from October, 1871, to April, 1872 . . . . . . . . . | | $8,989 00 |

### 1872.

| | | |
|---|---|---|
| Total water rates assessed from April, 1872, to April, 1873 . . . . . . . . . . . | | $27,404 51 |

### 1873.

| | | |
|---|---|---|
| Amount collected during the year . . . . | $47,992 61 | |
| Due and uncollected at close of the year . | 3,393 89 | |
| | | $51,386 50 |
| Gain in assessments, as compared with 1872* . . . . . . . . . . . . . . . | | $23,981 99 |

### 1874.

| | | |
|---|---|---|
| Amount collected during the year . . . . | $53,683 36 | |
| Due and uncollected at close of the year . | 3,194 63 | |
| | | $56,877 99 |
| Deduct amount due at the commencement of the year . . . . . . . . . . . . . | | 3,393 89 |
| Assessment for 1874 . . . . . . . . . . . | | $53,484 10 |
| Gain in assessment over 1873† . . . . . | | $2,097 60 |

---

*Appropriation this year, by the City Council, of $10,000 on account of Fire Hydrants, which has since been continued.

†Meters having been set in many business establishments during the year, the sum due for the quarter ending March 31st, 1875, amounting to $2,185.37, should be added in order to show a just comparison with the previous year, the income for that term being required to make a full year.

### 1875.

| | | |
|---|---|---|
| Amount collected during the year . . . . | $52,553 26 | |
| Due and uncollected at close of the year . | 3,871 58 | |
| | | $56,424 84 |
| Deduct amount due at the commencement of the year . . . . . . . . . . . . . . | | 3,194 63 |
| Assessment for 1875 . . . . . . . . . . . | | $53,230 21 |
| Decrease in assessments as compared with 1874* . . . . . . . . . . . . . . . . | | $253 89 |

---

*This year the rates for metered water were reduced, subjecting the department to a loss of $1,702.80; and abatements were made, as elsewhere explained, amounting to $2,013.63, on account of the freezing of the pipes.

## STATEMENT,

### SHOWING THE NUMBER OF FAMILIES, STORES, MANUFACTORIES, ETC., SUPPLIED WITH WATER.

| | | | |
|---|---|---|---|
| Families | 3,468 | Printing Offices | 7 |
| Hand Hose | 1,080 | Blacksmith Shops | 7 |
| Stores | 226 | Bakeries | 10 |
| Offices | 66 | Fire Engine and Hose Houses | 6 |
| Shoe Factories | 130 | Greenhouses | 21 |
| Morocco Factories | 15 | Fountains | 11 |
| Boarding Houses | 75 | Public Halls | 7 |
| Hotels | 5 | Almshouse | 1 |
| Restaurants | 19 | City Hall | 1 |
| Private Stables | 152 | Post Office | 1 |
| Livery Stables | 9 | Gas Works | 1 |
| Steam Engines | 43 | Railroads | 3 |
| Markets | 26 | Boilers for Heating | 23 |
| School Houses | 27 | Foundry | 1 |
| Churches | 11 | Barber Shops | 9 |
| Planing Mills | 3 | Motors | [illegible] |

### NUMBER OF FIXTURES.

| | 1874. | 1875. | Increase |
|---|---|---|---|
| Faucets | 6045 | 6582 | 538 |
| Bath Tubs | 314 | 342 | 28 |
| Water Closets | 847 | 967 | 120 |
| Hand Hose | 1061 | 1080 | 19 |

# Report of the Superintendent.

*To the President of the Public Water Board:*

I have the honor to present herewith the Annual Report of the Superintendent for the year ending December 31st, 1875.

## PONDS.

Owing to the severe drouth which prevailed during the summer and fall of 1874, and the early part of 1875, the ponds were drawn much lower than they ever were before, Breed's Pond having been drawn down, on the 18th of February, to only two feet ten inches in depth, and Birch Pond to four feet ten inches.

The ice, over a large part of the area of the ponds, was solid to the bottom. When the thaw commenced, in February, the water flowed rapidly into the ponds and raised the ice with everything attached. Large quantities of stumps, roots, &c., were in this way brought to the surface. All these have since been removed, with the exception of a few in Breed's Pond, which can be more easily taken out in the spring.

After the thaw commenced the ponds continued to rise until the 23d of June, when Breed's Pond stood at sixteen feet one and one-half inches, two feet less than

## STATEMENT,

### SHOWING THE NUMBER OF FAMILIES, STORES, MANUFACTORIES, E SUPPLIED WITH WATER.

| | | |
|---|---|---|
| Families | 3,468 | Printing Offices |
| Hand Hose | 1,080 | Blacksmith Shops |
| Stores | 226 | Bakeries |
| Offices | 66 | Fire Engine and Hose House |
| Shoe Factories | 130 | Greenhouses |
| Morocco Factories | 15 | Fountains |
| Boarding Houses | 75 | Public Halls |
| Hotels | 5 | Almshouse |
| Restaurants | 19 | City Hall |
| Private Stables | 152 | Post Office |
| Livery Stables | 9 | Gas Works |
| Steam Engines | 43 | Railroads |
| Markets | 26 | Boilers for Heating |
| School Houses | 27 | Foundry |
| Churches | 11 | Barber Shops |
| Planing Mills | 3 | Motors |

## NUMBER OF FIXTURES.

| | 1874. | 1875. |
|---|---|---|
| Faucets | 6045 | 6582 |
| Bath Tubs | 314 | 342 |
| Water Closets | 847 | 967 |
| Hand Hose | 1061 | 1080 |

at the same date of the previous year; and Birch Pond stood at eleven feet six and one-half inches, three inches less than last year.

The rainfall for the year, having been fully up to the average, has kept the supply a little above the demand, and on the 31st of December Breed's Pond contained nine feet one inch, and Birch Pond contained nine feet nine inches. The total yield of water from the ponds, during the year, including the surplus remaining on hand January 1st, 1876, was equal to 47.75 per cent. of the rainfall—or 19.91 inches—on the total drainage area, exclusive of water surfaces.

During a portion of the summer and early fall we suffered, in common with many other New England cities, from the bad quality of the water. The most careful scientific and microscopic investigations have failed fully to account for the cause. Most of the investigators refer it to the extreme dryness of the previous year, and the consequent low stage to which the water was drawn in the ponds. All the investigators agree that the objectionable qualities of the water are confined exclusively to the taste and odor, and that the water does not contain anything which is in the least injurious to health. Professor Johnson, in his report of June, 1875, upon the water furnished the city of New Haven, where the water was similarly affected with our own, says that "By filtration through charcoal, the water is entirely freed from all unpleasant smell and

## RESERVOIR.

The slopes of the reservoir embankments were slightly washed by the spring rains. They were repaired, resowed with grass seed and rolled. I think they will have to be covered with a few inches of loam before the grass will root well. The opinion expressed in the last Report, that the small leak then existing in the reservoir would gradually cease, appears to be fully verified. From observations made this year it has nearly ceased, and is so slight now as to be hardly perceptible.

The road around the reservoir is in good condition, but the road from Oak street up to the reservoir is almost impassable, and will need early attention.

## PUMPING STATION.

The Engine House is in good condition. Some slight repairs upon the roof is all that has been required for the year. A fence around the grounds and some grading are very much needed.

The engine and boilers are now in excellent condition. Mr. Holmes, who had been in charge as Engineer from the commencement of the Works, resigned on the first of September, and Mr. W. H. Messinger, a competent and skillful marine engineer, was appointed by the Board to the vacant position.

The boilers have required only slight repairs. They have been examined and tested by the United States Inspectors, and pronounced in first-rate condition. An unfortunate accident which happened to the valve-chamber of the pump has necessitated expensive repairs. On the 18th of September the valve-plate of the lower valve-chamber was broken entirely off. A crack in the chamber near the bottom flange and parallel with it, which, from its appearance, seemed to have been gradually increasing for many months, was the cause of the final rupture, but, being below the level of the water, it had escaped the notice of the Engineer in charge.

As soon as the extent of the damage was ascertained, arrangements were made with Messrs. I. P. Morris & Co., of Philadelphia, to furnish a new chamber, much thicker than the old one, with ribs extending from both the top and bottom flanges to the body of the chamber, thereby increasing its strength very materially. The design was promptly furnished by Mr. E. D. Leavitt, Jr., the patentee of the engine.

The chamber is six feet in diameter, four feet deep, and weighs six thousand pounds. It was put into its place in the bottom of the pump well without accident, and the pump was ready to start up again in twenty-two days from the time the accident occurred.

Much credit is due to Messrs. I. P. Morris & Co., for the promptness with which they furnished the new chamber and the perfect accuracy with which it was fitted ; to Mr. Leavitt, for his prompt assistance and improved design ; and also to Mr. Messinger, the Engineer in charge of the Works, for his untiring exertions to get the pump in running order in the shortest possible time. Immediately after the accident the small Duplex Pump was put in order, and started up without loss of time, an assistant engineer engaged for running nights, and the pump kept running day and night until the repairs on the large pump were completed. By taking this precaution, and the fact of its being the season of the year when the consumption of water is at the minimum, the supply was kept up equal to the demand, and no inconvenience was experienced by the citizens.

The total number of gallons pumped during the year has been 479,766,301. The total number of gallons drawn from the reservoir for the same time has been 471,387,756.

## PIPES.

The pipes are all in good condition. Only one small joint leak has occurred on the force main during the year. Owing to the severity of the last winter, and the great depth to which the frost penetrated, we, in common with almost every other New England city, suffered severely by having many of the distributing mains frozen, causing us a great deal of labor and expense, and much inconvenience to the water takers. The frost penetrated in some localities to the depth of five or six feet. In one place it was found to be five feet three inches on the 28th of April; in another, a dead end, the pipe was not cleared of ice till the 27th of May; 15,300 feet of streets were deprived of water on account of the mains being frozen; 832 services were frozen in the ground, and a large force had to be kept constantly employed in thawing them out. In many instances the frost was so solid around the pipes that they would freeze in a few hours after being thawed out. 34 pieces of main pipe, 5 hydrants, 3 gates and 339 services, were burst by the frost and had to be replaced at once; 240 feet of 8-inch pipe, 970 feet of 6-inch, 438 feet of 4-inch, 4 hydrants and 4 gates, had to be taken up and relaid on account of the lowering of the street grades, 335 feet of which was through solid rock; 760 feet of pipe laid in courts, and 47 services, have been lowered; 18 new gate-boxes have been put in, to replace old ones that were rotten; 130 leaks in main pipes, 47 leaks in gates, 61 leaks in hydrants and 13 leaks in services, have been repaired, in addition to those burst by frost.

The street mains have been extended this year by the addition of 641 feet of 6-inch, 941 feet of 4-inch, and 946 feet of 1½ and 2-inch pipes. One 10-inch gate has been set in Munroe street, at the corner of Market street, on an old line of pipe; two 6-inch gates and three 4-inch gates have been set in connection with new pipe; five new hydrants of the Holyoke pattern have been set, three of them in the streets leading from Market street, giving the Fire Department increased facilities for obtaining a copious supply of water in the rear of the high buildings in that thoroughfare; 161 services, 2 stand-pipes for water carts and one stand-pipe for fire purposes, have been put in this year, of a total length of 2315 feet; making the total length of service pipe laid in the city 25 miles 5147 feet.

Our new Work Shop and Stable has just been completed and occupied. It will prove of great advantage in carrying on the work of the department, and an economical arrangement for the city.

You will please find the usual Tables annexed.

Respectfully submitted,

DANIEL WALDEN, *Supt.*

# TABLE II.

Showing the Duty of the Leavitt Engine for the Year 1875, with the Cost of Pumping.

| MONTH. | Number of pumping days. | Average pumping time per day. | | Total pumping time per Mo. | | Total number of Revolutions. | Average Revolutions per min. | Raising steam. | Coal consumed. | | | Ashes and cinders. | Ashes and cinders. | Total number of Galls. pumped per month, allowing 4 per cent. for loss of action in the pump. | Average number of Gallons pumped per lb. of coal consumed. | Average number of Gallons raised 100 feet high per lb. of coal consumed. | Average head against the pump. | Average duty in lbs. of Water raised 1 foot high per 100 lbs. of coal consumed, calculated on total coal consumed; no deduction for ashes or cind. | Duty in lbs. of water raised 1 foot high per 100 lbs. of coal consumed, calculated on total coal consumed, deducting ashes and cinders. | Duty on coal used in pumping only; no deduction for ashes and cinders. | Duty on coal used in pumping only; ashes and cinders deducted. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Pumping. | Banking. | Total. | | | | | | | | | | |
| | Dys | H. | M. | H. | M. | Revo'ns | Rev. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | p.ct. | Gallons. | Galls. | Galls. | Feet. | Lbs. | Lbs. | Lbs. | Lbs. |
| January .. | 12 | 13 | 10 | 158 | | 169,205 | 17.85 | 9,650 | 39,000 | 2,700 | 51,350 | 5,767 | 11.23 | 31,565,193 | 614.7 | 1015.28 | 165.167 | 88,155,398 | 99,308,507 | 116,071,274 | 130,733,543 |
| February . | 10 | 15 | 22 | 153 | 45 | 168,954 | 18.31 | 7,100 | 39,950 | 1,500 | 48,550 | 5,457 | 11.24 | 31,518,369 | 649.19 | 1069.62 | 164.762 | 92,873,358 | 104,634,199 | 112,866,121 | 127,157,403 |
| March .... | 17 | 15 | 32 | 267 | | 296,834 | 18.74 | 12,400 | 67,550 | 4,200 | 84,150 | 9,208 | 10.94 | 55,374,383 | 658.04 | 1081.27 | 164.317 | 93,882,027 | 105,421,602 | 118,438,279 | 131,327,095 |
| April ..... | 18 | 15 | 13 | 273 | 50 | 304,840 | 18.55 | 12,500 | 68,500 | 4,500 | 85,500 | 10,261 | 12. | 56,867,902 | 665.12 | 1081.62 | 162.62 | 93,917,954 | 106,726,366 | 117,226,059 | 133,213,640 |
| May ...... | 16 | 14 | 54 | 238 | 30 | 265,264 | 18.53 | 12,000 | 61,500 | 3,900 | 77,400 | 10,157 | 13.15 | 49,484,999 | 639.34 | 1050.82 | 164.37 | 91,239,392 | 105,029,883 | 114,837,796 | 132,182,752 |
| June...... | 12 | 15 | 06 | 181 | 15 | 200,666 | 18.45 | 8,200 | 47,400 | 2,400 | 58,000 | 8,338 | 14.4 | 37,434,242 | 645.4 | 1061.22 | 164.43 | 92,145,452 | 107,618,224 | 112,751,819 | 131,681,768 |
| July ...... | 14 | 15 | 24 | 215 | 35 | 239,382 | 18.5 | 10,850 | 53,850 | 2,700 | 67,400 | 9,120 | 13.53 | 44,656,712 | 662.56 | 1084.38 | 163.67 | 94,154,606 | 108,891,552 | 117,849,575 | 136,298,611 |
| August. .. | 12 | 15 | 12 | 182 | 25 | 204,713 | 18.7 | 9,400 | 45,800 | 2,400 | 57,600 | 6,574 | 11.41 | 38,189,210 | 663. | 1091.45 | 164.62 | 94,763,017 | 106,977,937 | 119,184,633 | 134,539,107 |
| September | 8 | 14 | 01 | 112 | 10 | 125,641 | 18.53 | 8,000 | 30,050 | 1,700 | 39,750 | 4,422 | 11.12 | 23,438,328 | 589.64 | 974.08 | 165.28 | 84,469,250 | 95,212,089 | 111,935,197 | 125,909,038 |
| October... | 8 | 13 | 57 | 111 | 38 | 125,756 | 18.77 | 6,600 | 30,550 | 1,500 | 38,650 | 5,177 | 13.39 | 23,459,782 | 606.98 | 993.3 | 163.65 | 86,247,454 | 99,587,463 | 109,116,568 | 125,992,560 |
| November | 9 | 14 | 53 | 133 | 55 | 149,318 | 18.58 | 8,450 | 35,900 | 1,500 | 45,850 | 5,776 | 12.59 | 27,855,273 | 607.53 | 1003.26 | 165.137 | 87,110,402 | 99,667,311 | 111,255,371 | 127,288,795 |
| December | 12 | 15 | 20 | 184 | | 205,818 | 18.64 | 11,300 | 48,050 | 2,100 | 61,450 | 7,125 | 11.59 | 38,395,348 | 624.82 | 1035.93 | 165.797 | 89,882,434 | 101,745,414 | 115,032,666 | 130,118,873 |
| Tot. & av's | 148 | 14 | 57 | 2212 | 03 | 2,456,391 | 18.73 | 116,450 | 568,100 | 31,100 | 715,650 | 87,382 | 12.21 | 458,239,741 | 635.53 | 1045.18 | 164.485 | 91,448,679 | 104,167,723 | 115,200,224 | 131,222,487 |

## COST OF PUMPING WITH LEAVITT ENGINE.

| | |
|---|---|
| 715,650 lbs. of coal, average price \$7.27¾ per net ton | \$2,604 17 |
| 5¾ cords of wood, average price per cord \$7.56½ | 43 50 |
| 64,168 lbs. of coal for heating average price \$7.32 | 234 89 |
| Lighting, \$48.20; sundries, \$60.42 | 108 62 |
| Oil, waste and packing | 215 04 |
| Repairs to Engine and Boilers | 1,446 40 |
| Wages of Engineer, Fireman, and extra labor | 1,891 72 |
| | \$6,544 34 |

| | |
|---|---|
| Cost of raising one million gallons into the reservoir | \$14 28$\frac{14}{100}$ |
| Cost of raising one million gallons one foot high | 08$\frac{66}{100}$ |

# TABLE II.

SHOWING THE DUTY OF THE LEAVITT ENGINE FOR THE YEAR 1875, WITH THE COST OF PUMPING.

| | Number of pumping days. | Average pumping time per day. | | Total pumping time per Mo. | | Total number of Revolutions. | Average Revolutions per min. | Coal consumed. | | | | Ashes and cinders. | Ashes and cinders. | Total number of Galls. pumped per month, allowing 4 per cent. for loss of action in the pump. | Average number of Gallons pumped per lb. of coal consumed. | Average number of Gallons raised 100 feet high per lb. of coal consumed. | Average head against the pump. | Average duty in lbs. of Water raised 1 foot high per 100 lbs. of coal consumed, calculated on total coal consumed; no deduction for ashes or cind. | Duty in lbs. of water raised 1 foot high per 100 lbs. of coal consumed, calculated on total coal consumed, deducting ashes and cinders. | Duty on coal used in pumping only; no deduction for ashes and cinders. | Duty on coal used in pumping only; ashes and cinders deducted. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Raising steam. | Pumping. | Banking. | Total. | | | | | | | | | | |
| MONTH. | Dys | H. | M. | H. | M. | Revo'ns | Rev. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | p.ct. | Gallons. | Galls. | Galls. | Feet. | Lbs. | Lbs. | Lbs. | Lbs. |
| January .. | 12 | 13 | 10 | 158 | | 169,205 | 17.85 | 9,650 | 39,000 | 2,700 | 51,350 | 5,767 | 11.23 | 31,565,193 | 614.7 | 1015.28 | 165.167 | 88,155,398 | 99,308,507 | 116,071,274 | 130,733,543 |
| February . | 10 | 15 | 22 | 153 | 45 | 168,954 | 18.31 | 7,100 | 39,950 | 1,500 | 48,550 | 5,457 | 11.24 | 31,518,369 | 649.19 | 1069.62 | 164.762 | 92,873,358 | 104,634,199 | 112,866,121 | 127,157,403 |
| March ..... | 17 | 15 | 32 | 267 | | 296,834 | 18.74 | 12,400 | 67,550 | 4,200 | 84,150 | 9,208 | 10.94 | 55,374,383 | 658.04 | 1081.27 | 164.317 | 93,882,027 | 105,421,602 | 118,438,279 | 131,327,095 |
| April ...... | 18 | 15 | 13 | 273 | 50 | 304,840 | 18.55 | 12,500 | 68,500 | 4,500 | 85,500 | 10,261 | 12. | 56,867,902 | 665.12 | 1081.62 | 162.62 | 93,917,954 | 106,726,366 | 117,226,059 | 133,213,640 |
| May ....... | 16 | 14 | 54 | 238 | 30 | 265,264 | 18.53 | 12,000 | 61,500 | 3,900 | 77,400 | 10,157 | 13.15 | 49,484,999 | 639.34 | 1050.82 | 164.37 | 91,239,392 | 105,029,883 | 114,837,796 | 132,182,752 |
| June....... | 12 | 15 | 06 | 181 | 15 | 200,666 | 18.45 | 8,200 | 47,400 | 2,400 | 58,000 | 8,338 | 14.4 | 37,434,242 | 645.4 | 1061.22 | 164.43 | 92,145,452 | 107,618,224 | 112,751,819 | 131,681,768 |
| July ....... | 14 | 15 | 24 | 215 | 35 | 239,382 | 18.5 | 10,850 | 53,850 | 2,700 | 67,400 | 9,120 | 13.53 | 44,656,712 | 662.56 | 1084.38 | 163.67 | 94,154,606 | 108,891,552 | 117,849,575 | 136,298,611 |
| August. .. | 12 | 15 | 12 | 182 | 25 | 204,713 | 18.7 | 9,400 | 45,800 | 2,400 | 57,600 | 6,574 | 11.41 | 38,189,210 | 663. | 1091.45 | 164.62 | 94,763,017 | 106,977,937 | 119,184,633 | 134,539,107 |
| September | 8 | 14 | 01 | 112 | 10 | 125,641 | 18.53 | 8,000 | 30,050 | 1,700 | 39,750 | 4,422 | 11.12 | 23,438,328 | 589.64 | 974.08 | 165.28 | 84,469,250 | 95,212,089 | 111,935,197 | 125,909,038 |
| October... | 8 | 13 | 57 | 111 | 38 | 125,756 | 18.77 | 6,600 | 30,550 | 1,500 | 38,650 | 5,177 | 13.39 | 23,459,782 | 606.98 | 993.3 | 163.65 | 86,247,454 | 99,587,463 | 109,116,568 | 125,992,560 |
| November | 9 | 14 | 53 | 133 | 55 | 149,318 | 18.58 | 8,450 | 35,900 | 1,500 | 45,850 | 5,776 | 12.59 | 27,855,273 | 607.53 | 1003.26 | 165.137 | 87,110,402 | 99,667,311 | 111,255,371 | 127,288,795 |
| December | 12 | 15 | 20 | 184 | | 205,818 | 18.64 | 11,300 | 48,050 | 2,100 | 61,450 | 7,125 | 11.59 | 38,395,348 | 624.82 | 1035.93 | 165.797 | 89,882,434 | 101,745,414 | 115,032,666 | 130,118,873 |
| Tot. & av's | 148 | 14 | 57 | 2212 | 03 | 2,456,391 | 18.73 | 116,450 | 568,100 | 31,100 | 715,650 | 87,382 | 12.21 | 458,239,741 | 635.53 | 1045.18 | 164.485 | 91,448,679 | 104,167,723 | 115,200,224 | 131,222,487 |

| | | |
|---|---|---|
| 715,650 lbs. of coal, average price $7.27¾ per net ton | $2,604 | 17 |
| 5¾ cords of wood, average price per cord $7.56½ | 43 | 50 |
| 64,168 lbs. of coal for heating, average price $7.32 | 234 | 89 |
| Lighting, $48.20 ; sundries, $60.42 | 108 | 62 |
| Oil, waste and packing | 215 | 04 |
| Repairs to Engine and Boilers | 1,446 | 40 |
| Wages of Engineer, Fireman, and extra labor | 1,891 | 72 |
| | $6,544 | 34 |

| | | |
|---|---|---|
| Cost of raising one million gallons into the reservoir | $14 | $28\frac{14}{100}$ |
| Cost of raising one million gallons one foot high | | $08\frac{68}{100}$ |

## TABLE III.

### CONSUMPTION OF WATER FOR THE YEAR ENDING DEC. 31, 1875.

| Month. | Water drawn from Reservoir. | Average consumption per day. | Average daily increase. | Average daily decrease. | Average to each consumer. |
|---|---|---|---|---|---|
| | Gallons. | Gallons. | Gallons. | Gallons. | Galls. |
| January . . . . . . | 31.602.008 | 1.019,419 | | | 58.79 |
| February . . . . . . | 33.273.916 | 1.188.354 | 168.935 | | 68.53 |
| March . . . . . . . | 54.711.366 | 1.764.883 | 576,529 | | 101.78 |
| April . . . . . . . . | 53.035.009 | 1.767.833 | 2.950 | | 101.95 |
| May . . . . . . . . | 45.252.993 | 1.459.774 | | 308.059 | 84.18 |
| June . . . . . . . . | 41.372.035 | 1.379.068 | | 80.706 | 79.53 |
| July . . . . . . . . | 44.630.066 | 1,439.679 | 60.611 | | 83.02 |
| August . . . . . . . | 37.546.374 | 1.214.399 | | 225.280 | 70.03 |
| September . . . . . | 35.170.411 | 1.172.347 | | 42.052 | 67.60 |
| October . . . . . . | 30.627.779 | 987.993 | | 184.354 | 56.98 |
| November . . . . . | 30.513.577 | 1.017,119 | 29.126 | | 58.65 |
| December . . . . . | 33.652.223 | 1.085.555 | 68.436 | | 62.60 |
| Totals and averages. | 471.387.757 | 1.291,471 | | | 71.48 |

## TABLE IV.

### SHOWING THE DEPTH OF WATER AT THE PONDS FOR EACH WEEK DURING THE YEAR 1875.

| Date. | | Breed's Pond. Ft. | Breed's Pond. In. | Birch Pond. Ft. | Birch Pond. In. | Date. | | Breed's Pond. Ft. | Breed's Pond. In. | Birch Pond. Ft. | Birch Pond. In. | Date. | | Breed's Pond. Ft. | Breed's Pond. In. | Birch Pond. Ft. | Birch Pond. In. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. | 2 | 5 | 3 | 8 | 1 | May | 15 | 14 | 7 | 11 | 2 | Sept. | 25 | 10 | 7½ | 9 | 2½ |
| | 9 | 4 | 5 | 7 | 10 | | 22 | 14 | 9 | 11 | 2 | Oct. | 2 | 10 | 2 | 9 | 2½ |
| | 16 | 4 | 5 | 7 | 6 | | 29 | 14 | 8 | 10 | 9 | | 9 | 10 | 0½ | 9 | 4 |
| | 23 | 4 | 8 | 7 | 1 | June | 5 | 14 | 5 | 10 | 5 | | 16 | 9 | 5½ | 9 | 2 |
| | 30 | 4 | 10 | 6 | 6 | | 12 | 15 | 8½ | 11 | 5½ | | 23 | 9 | 3 | 9 | 1½ |
| Feb. | 6 | 5 | 2 | 6 | 2 | | 19 | 16 | | 11 | 6 | | 30 | 8 | 6½ | 8 | 11 |
| | 13 | 5 | 4 | 5 | 9 | | 26 | 15 | 11 | 11 | 5 | Nov. | 6 | 8 | 5 | 8 | 11½ |
| | 20 | 2 | 10 | 4 | 10 | July | 3 | 15 | 4 | 11 | 1 | | 13 | 8 | 9½ | 9 | 3 |
| | 27 | 7 | 2½ | 5 | 11 | | 10 | 14 | 11½ | 11 | | | 20 | 9 | 3 | 9 | 5 |
| Mar. | 6 | 7 | 6 | 6 | 4 | | 17 | 14 | 5½ | 10 | 8½ | | 27 | 9 | 10½ | 9 | 8 |
| | 13 | 6 | 6 | 6 | 7 | | 24 | 14 | | 10 | 7½ | Dec. | 4 | 10 | | 9 | 9 |
| | 20 | 8 | 3 | 7 | 11 | | 31 | 13 | 6 | 10 | 6 | | 11 | 9 | 10½ | 9 | 9 |
| | 27 | 8 | 1 | 8 | 5 | Aug. | 7 | 13 | 2 | 10 | 7½ | | 18 | 9 | 6½ | 9 | 9 |
| April | 3 | 9 | 6 | 9 | | | 14 | 12 | 11½ | 10 | 1½ | | 25 | 9 | 5 | 9 | 9 |
| | 10 | 12 | 5½ | 10 | 6 | | 21 | 12 | 7½ | 9 | 11½ | | 31 | 9 | 1 | 9 | 9 |
| | 17 | 13 | 5 | 11 | | | 28 | 12 | 2 | 9 | 8 | | | | | | |
| | 24 | 13 | 7½ | 11 | | Sept. | 4 | 11 | 7½ | 9 | 5½ | | | | | | |
| May | 1 | 13 | 9 | 10 | 8½ | | 11 | 11 | | 9 | 4 | | | | | | |
| | 8 | 14 | 1½ | 11 | 0½ | | 18 | 11 | | 9 | 4 | | | | | | |

# TABLE V.

SHOWING THE RAINFALL FOR THE YEAR 1875, AND THE DAYS ON WHICH IT OCCURRED.

| Days of Mo. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | 1.120 | | .410 | | | | | .400 | | |
| 2 | .600 | | | | | | | | | | | |
| 3 | | .470 | | | | .032 | | 1.950 | | | | |
| 4 | | | .530 | | | | | .220 | | | | |
| 5 | | | | 2.600 | | | .520 | | | | | |
| 6 | | | | | | | .270 | | .223 | | | |
| 7 | .570 | | | | 2.260 | .700 | | | | 2.500 | | |
| 8 | | | .700 | | | | | .200 | | | | |
| 9 | | | | | .300 | 4.120 | | | | | | .076 |
| 10 | | | | | | | | | .346 | | 1.446 | |
| 11 | | .700 | | | | | | | | .080 | | |
| 12 | | | | | | .160 | | | | | | |
| 13 | .200 | | | | | | | | .280 | | | |
| 14 | | | | .840 | | | | | | | .400 | |
| 15 | | | 1.200 | | .160 | | | | 1.420 | | | |
| 16 | | | .080 | .100 | | | .220 | .130 | 1.292 | .460 | .500 | .166 |
| 17 | | | | | | | | | | | | |
| 18 | .056 | | | | | .555 | .170 | .510 | | | | |
| 19 | | | | | .190 | | | | .110 | | | |
| 20 | | .330 | .500 | | | | | | | | | |
| 21 | | | | | | | | | | | | |
| 22 | .610 | | | | .120 | | | .120 | | | .866 | |
| 23 | | | | | | | .710 | | | | | |
| 24 | .610 | | .200 | | | | | | | | | |
| 25 | | .926 | | | | | | | | | | .210 |
| 26 | | | | | | | | | .525 | | .430 | .432 |
| 27 | | .354 | | | | | | | | .210 | | |
| 28 | | | | | | | | | | | .334 | |
| 29 | .670 | | | | | | .150 | | .080 | | | .104 |
| 30 | | | | | | | | | | .724 | | |
| 31 | | | | | | | | | | | | |
| Mo. Tots. | 3.316 | 2.780 | 4.330 | 3.540 | 3.440 | 5.567 | 2.040 | 3.130 | 4.276 | 4.464 | 3.976 | .988 |

TOTAL RAINFALL FOR THE YEAR, 41.847 INCHES.

## TABLE VI.

### SHOWING THE AMOUNT OF PIPE LAID IN 1875.

| NAMES OF STREETS. | | | SIZE OF PIPE IN INCHES. | | | | | |
|---|---|---|---|---|---|---|---|---|
| Street. | From | To | 10 | 8 | 6 | 4 | 2 | 1¼ |
| Andrew . . . . | Market . . . | Central Ave. | | | 640.9 | | | |
| Boston . . . . | Kirtland . . | North Federal | | | | 499 | | |
| Brownville Ct. | Essex . . . . | | | | | 442 | | |
| Sargent's Ct. . | Boston . . . | | | | | | 400 | 143 |
| Norwood Ct. . | No. Franklin | Relay Ct. . . | | | | | | 191 |
| Relay Ct. . . . | Norwood . . | | | | | | | 172 |
| Mechanics Ct. . | Essex . . . . | | | | | | | 206 |
| | | | | | 640.9 | 941 | 400 | 712 |

| | | |
|---|---|---|
| Total extension of Pipe in 1875 . . . . . . . . . | | 2,654 ft. |
| Previously laid . . . . . . . . . . . . . . . . . . . | 48 miles | 727 ft. |
| Total amount of Pipe laid to date . . . . . . . . | 48 miles | 3,381 ft. |

## TABLE VII.

### SHOWING THE NUMBER AND LOCATION OF HYDRANTS SET IN 1875.

| Street. | Location. |
|---|---|
| Andrew . . . . . | 320 feet east from Market Street. |
| Brownville Court . | 300 feet north from Essex Street. |
| Oxford . . . . . | 325 feet east from Market Street. |
| Rand . . . . . . | 950 feet west from Chestnut Street. |
| Summer . . . . . | 285 feet west from Market Street. |

| | |
|---|---|
| Hydrants set in 1875 . . . . . . . . . . . | 5 |
| Hydrants previously set . . . . . . . . . | 356 |
| Total . . . . . . . . . . . . . . . . . . . . | 361 |

# TABLE VIII.

## Showing the Number and Location of Gates set in 1875.

| Street. | Location. | No. | Inches. |
|---|---|---|---|
| Andrew . . . | On a line with east line of Market St.<br>18′ 3″ south of north line of Andrew Street. | 1 | 6 |
| Andrew . . . | 1′ west of west line of Central Avenue.<br>43′ 8″ north of south line of Andrew Street. | 1 | 6 |
| Boston . . . . | 1′ east of east line of Kertland Street.<br>28′ 9″ north of south line of Kertland Street. | 1 | 4 |
| Boston . . . . | On a line with west line of N. Federal Street.<br>40′ north of south line of Boston Street. | 1 | 4 |
| Brownville Ct. | 1′ north of north line of Essex Street.<br>12′ 9″ east of west line of Brownville Court. | 1 | 4 |
| Munroe . . . . | 3′ 6″ east of east line of Market Street.<br>16′ 10″ south of north line of Munroe Street. | 1 | 10 |
| Norwood Ct. . | 5′ west from the east line of N. Franklin St.<br>7′ 2″ north of south line of Norwood Court. | 1 | 1½ |
| Mechanics Ct. . | On a line with south side of Essex Street.<br>7′ 6″ west from east line of Mechanics Court. | 1 | 1½ |
| | Total gates set in 1875 . . . . . . . . . . | 8 | |
| | Previously set . . . . . . . . . . . . . . | 311 | |
| | Total . . . . . . . . . . . . . . . . . . | 319 | |

## FURNITURE AND SUPPLIES AT ENGINE HOUSE.

1 library table.
4 chairs.
1 clock.
9 brass lamps and brackets.
2 glass lamps and brackets.
6 hand lamps.
2 lanterns.
3 doz. chimneys.
3 thermometers.
2 indicators.
1 feather duster.
1 dust pan and brush
1 platform scale.
1 iron wheelbarrow.
1 wood wheelbarrow.
2 sets fire tools.
2 coal shovels.
5 ladles.
2 pails.
1 bench and vise.
1 ratchet and set of drills.
1 breast drill.
1 set of taps and dies.
2 monkey wrenches.
13 S wrenches.
3 socket wrenches.
4 crowfoot wrenches.
1 hydrant wrench.
4 gate keys.
1 service key.
2 spanners.
2 copper hammers.
3 hand hammers.
1 carpenter's hammer.
1 sledge hammer.
1 hatchet.
1 screw driver.
7 cold chisels.
2 steel bars.
2 chisel bars.
8 packing hooks and screws.
10 files.
1 pair caulipers.
6 steel wedges.
6 glass tubes for boiler gauges.
1 ladder.
1 coal screen.
1 set of blocks and fall.
10 lbs. red lead.
20 lbs. white lead.
75 lbs. cotton waste.
15 lbs. Martin's packing.
20 lbs. Selden's packing.
15 lbs. hemp packing.
20 lbs. rubber packing.
3 lbs. cotton packing.
8 lbs. American packing.
5 oil cans.
1 set of oilers.
8 gallons cylinder oil.
5 gallons lubricating oil.
2 gallons kerosene oil.
1 cord small wood.
6 steam valves.
6 pump valves.
6 copper studs for valve seats.
2 doz. brass nuts for valve seats.
6 valves, Worthington Pump.
3 air pump valves.
½ doz. gauge cocks.
2½ doz. valve springs.
3 unions.
1 No. 1 Blake Pump.
80 shovels.
22 spades.
5 scythes.
19 brush hooks.
4 mattocks.
5 picks.
1 12-inch gate.
1 10-inch gate.
25 feet 12-inch water pipe.
250 fire bricks.
1 ton Cumberland coal.
35 tons anthracite coal.

# FIFTH ANNUAL REPORT

OF THE

# UBLIC WATER BOARD

OF THE

# CITY OF LYNN,

FOR THE YEAR ENDING DEC. 31, 1876.

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# CITY OF LYNN.

---

IN BOARD OF MAYOR AND ALDERMEN,
*December* 29, 1876.

*Ordered,* That the Public Water Board be and they are herel instructed to present their Annual Report in print to the Ci Council, as early as practicable; the same to be in form suitab to accompany the City Documents. The expense of the same be charged to the account of Printing and Stationery.

Sent down for concurrence.

CHAS. E. PARSONS, City Clerk.

---

IN COMMON COUNCIL, *Dec.* 29, 1876.

Adopted in concurrence.

S. HENRY KENT, Clerk.

---

A true copy. Attest:

CHAS. E. PARSONS, City Clerk

# Report of the Public Water Board.

In compliance with the "Ordinance for the Regulation of the Water Supply of the City," the Public Water Board hereby present their Fifth Annual Report to the City Council:

Accompanying will be found the Reports of the Clerk of the Board and of the Superintendent of the Works.

In the Clerk's Report will be found statements showing the receitps and expenditures for the year, the total expenditures and cost of the works to January, 1877, the number of consumers and number and kinds of fixtures in use, and much other information worthy of careful attention.

The Superintendent's Report gives the condition of the ponds and the reservoir, with tables showing the engine record and duty for each month in the year, the quantity of water used, the depth of water in the ponds for each week, the daily rainfall, the amount of pipe and number of services laid, and where located; also, diagrams from which may be seen at a glance the rainfall and consumption of water for each day in the year. These tables and diagrams have been prepared with great care by the Superintendent, and will be found very useful for comparison, or in obtaining a correct knowledge of the condition of the works; and we recommend them to all who desire thorough information on these subjects.

## SOURCES OF SUPPLY.

The rainfall the past year was $45.\frac{05}{100}$ inches, considerably above the average, and we may congratulate ourselves on the condition of the ponds, and that there is no immediate danger of a short supply of water. As will be seen by the tables of the Superintendent, Breed's Pond has gained three feet seven inches, and Birch Pond one foot, over the corresponding date of a year ago. This favorable condition is attributable not alone to the large rainfall, but to the decreased consumption, which, notwithstanding there has been an addition of over two hundred takers, is less than it was the previous year. Among the causes of this lessened consumption are the freedom from breaks in the pipes, from frost or otherwise; the rigid examination of fixtures, thereby preventing much waste; and the general economy prevailing among all classes, which has induced a saving in the quantity of water used, as in everything else, especially when the water is paid for according to meter measurements. This economy in use has reduced the average daily consumption to less than sixty gallons per head, a point much below the average of most other cities.

Owing to favorable circumstances we have thus far been saved from the calamity of a short supply of water;

yet the liability still exists, and with the reverse conditions, that are not only possible but liable to take place, we could not escape.

As long as we are exposed to this contingency we cannot be relieved from responsibility if we do not continue to urge upon the City Council the necessity of immediate action to increase our supply.

As has been stated in previous reports, " A water supply which in its minimum yield is not surely abundant cannot be regarded as competent, and hazards the welfare of the community it was intended to protect." In a year of low rainfall the consumption would exceed the supply, and we should have to draw largely from the storage basins, thus drawing them down to a point whereby the quality of the water would be affected, and so diminishing the quantity in store that, should another year of low rainfall follow, the supply would entirely fail and the city be deprived of water.

With a return of prosperity, and a revival of business, a large increase in the number of consumers, and in the demand for manufacturing purposes, would follow. This demand we must be prepared to meet, if we would encourage returning prosperity and enterprise.

Let us not be lulled into a feeling of fancied security because we are in no immediate danger. The consequences of a short supply of water, to a city depending upon it for domestic and manufacturing uses, would be too serious to allow us to take any risk. As the Mayor, in his Inaugural Address, aptly says: " For a community once accustomed to its use, to be deprived of it, even for a short period, would be a calamity. Relying on the sufficiency of the public supply, wells and cisterns have been abandoned, and our houses and factories have been fitted for the new order of things. Should this supply fail great inconvenience and discomfort would follow, and it becomes our duty to provide against such a contingency."

## QUALITY.

The prejudice that has existed against the quality of the water in the past is fast wearing away. There has been but little fault found with it during the past year, and except for a brief period in the heat of summer, when the water in one of the ponds had an unpleasant taste and smell, it has been generally acceptable to consumers. The water furnished by our city will compare favorably with that of any other city in the Commonwealth ; and if the supply was abundant, so as to obviate the necessity of drawing the ponds down to a low point, the quality would prove entirely satisfactory.

A public water supply, drawn from ponds or rivers, has to grow gradually in favor with any community. Accustomed to sparkling well-water, the pond water at first seems flat and insipid, but with use this soon wears away, and the most prejudiced would hardly be willing to return to the old wells, especially after a knowledge of the fact that in many localities the clear well-water often contains the germs of disease, the existence of which the palate gives no indication.

## INCOME AND RECEIPTS.

By referring to the Clerk's Report it will be seen that the gross income for the use of water, the past year, was $60,867.12. The interest on the water debt was $58,790.00, and the maintenance $11,806.57 ; leaving a deficiency, after paying the interest and maintenance, of $9,729.45. The strictest economy consistent with a proper management of the department has been practiced, and the expenses reduced to a minimum. We think we are warranted in the statement that they are less than those of any public water-works of equal extent in the State.

In one sense the department is not self-sustaining, as a small deficiency has to be provided for from the general appropriations. As an offset, the city is much more than compensated in the protection against fire, and the large saving in the rates of insurance on property.

In a city built as ours is, so largely of wood, the only safety lies in an abundant supply of water which can be promptly utilized in case of fire. With hydrants so located in the business center that from six to ten powerful streams can be turned on to any building, without delay, thus doing away, to a great extent, with the use of steamers, a security is furnished against fire that we think no one will question pays, many times over, the deficiency that has to be met by the city.

Soon after the earliest expenditures for the introduction of water the city commenced to furnish it to the public ; the receipts for its use keeping pace with the interest on the cost. Instead of waiting for the completion of costly works before taking on consumers, (thus burdening the department with a heavy charge for interest before returns came in), our water-rates have met the interest on the cost each year, leaving only a small deficiency for maintenance ; the whole deficiency, since the beginning of the works, amounting to less than the accumulation of interest which many of our neighboring cities have had to pay, on the cost of water-works, before a dollar of income was received.

## CONCLUSION.

In conclusion we would briefly enumerate what we have to show for the large outlay already incurred :

Two ponds, capable of storing 370,000,000 gallons of water, so located amidst our rocky hills that the watershed furnishes water of unexceptional purity, and is so uninviting for settlement that the danger of contamination from that source is very remote.

A distributing reservoir, with a capacity of 20,000,000 of gallons, located one hundred and seventy-seven feet above m. h. tide, furnishing a pressure of over sixty lbs. to the inch, and capable of forcing streams from the hydrants far above the tops of our highest buildings.

A pumping engine, that has thus far eclipsed all others built in this country in the duty it performs.

Forty-eight miles of street mains, more than has been called for in any other city of the size of ours; and over 3,400 services, connecting with the houses and places of business of consumers.

These items always form, by far, the largest proportion of the cost of any public water supply. To complete our works an addition to our present sources is needed.

If we should provide for this addition by taking the waters of Hawkes and Penny Brooks, as recommended by Mr. Kirkwood, "it will not be necessary that the whole works contemplated should be executed at once." The expense of the Hawkes Brook reservoir, the first one of the two proposed to be constructed, including the conduit connecting with our present sources, was estimated at less than $150,000. This estimate, the Water Board are of opinion is a liberal one, as it includes some things not necessary, and, if executed at the present prices of material and labor, would fall short of Mr. Kirkwood's estimates.

By this partial execution of the Hawkes Brook plan, and the addition of this one pond, our present supply would be more than doubled, furnishing water enough for all the probable demands of the city for from ten to fifteen years.

If in the future the growth of our city should require a still larger supply, then the completion of this scheme, by the addition of Penny Brook, at a small expense, would give all the water that this generation needs to provide for.

EDWIN WALDEN,
JAMES PURINTON,
JACOB M. LEWIS,
DAVID H. SWEETSER,
THOS. B. NEWHALL.

# Report of the Clerk.

*Hon. Edwin Walden, President of the Public Water Board:*

I have the honor to submit, herewith, the Annual Report of the Clerk of the Board for the year ending December 31st, 1876.

The number of services on the first of January, 1876, was 3,224. There have been put in, during the year, 202, and three have been discontinued on account of the removal of the buildings; making the total number of services on the first of January, 1877,—3,423.

One hundred and sixty-four services have been shut off during the year, by request, and two hundred and ninety-four have been let on. In addition to these there were shut off, for violation of the Rules in regard to hand hose, seventeen. They were let on again after the payment of a fine for each of two dollars. One hundred and forty-four have been shut off for non-payment of water rates, sixty-five of which, having paid the amount due with the addition of two dollars, have been let on again; leaving seventy-nine still remaining off.

Our calls for turning off and on the water are so frequent that it entails considerable expense upon the department, and a fee should be required for this service, as is done in other places.

The lease of the ice privilege at Breed's Pond expired last year, and the buildings have been removed. A settlement for back rent was made by the Board for five hundred dollars, which amount has been paid by the company this year.

Three meters have been added during the year, and five have been discontinued; making the number now in use one hundred.

278 tenements are now vacant.

There is now due on account of water, $2,723.17; on account of extra pipe, labor, &c., $387.14. All places supplied by the city with water have been visited during the year, and many leaky fixtures discovered, which have all been repaired.

The total receipts for the year have been as follows:

| | | |
|---|---|---|
| For water rates for all purposes | $60,090 12 | |
| For fines | 166 00 | |
| For Rents | 611 00 | |
| | | $60,867 12 |
| For extra pipe, labor, &c. | | 1,697 92 |
| Total receipts | | $62,565 04 |

All of which has been paid into the City Treasury.

| | | |
|---|---|---|
| Amount collected in 1876 | $60,867 12 | |
| Due and uncollected at close of year | 2,723 17 | |
| | | $63,590 29 |
| Deduct amount due at commencement of the year | | 3,871 58 |
| Revenue for 1876 | | 59,718 71 |
| Revenue for 1875, as per last Report | | 53,230 21 |
| Increase in 1876 | | $6,488 50 |

# STATEMENT

## Of Interest, Cost of Maintenance, and Water Receipts, to January 1st, 1877.

| | | |
|---|---|---|
| Interest for 1876 | $58,790 00 | |
| Interest accrued previously | 181,131 56 | |
| Total accrued interest to January 1st, 1877 | | $239,921 56 |
| Maintenance for 1876 | $11,806 57 | |
| Maintenance previously expended | 64,667 46 | |
| Total cost of maintenance to January 1st, 1877 | | $76,474 03 |
| Total cost of maintenance and accrued interest to January 1st, 1877 | | $316,395 59 |

### CREDIT.

| | | |
|---|---|---|
| Receipts for 1876 | $60,867 12 | |
| Previously received | 190,618 64 | |
| Bills due and uncollected | 2,273 17 | |
| | | $253,788 93 |
| Deficiency of income to meet interest and maintenance | | $62,056 66 |
| Amount of deficiency charged to construction account | $34,169 30 | |
| Balance of deficiency provided for by City Treasurer | 27,887 36 | |
| | | $62,056 66 |

## *EXPENDITURES FOR THE YEAR 1876.*

### MAINTENANCE.

| | | |
|---|---|---|
| Salaries and office expenses | $3,116 09 | |
| Repairs on services | 270 42 | |
| Repairs on mains, hydrants and gates | 819 80 | |
| Repairs on reservoir and road | 470 53 | |
| Surveys, and labor at Breed's Pond | 208 58 | |
| Labor at Birch Pond | 249 92 | |
| Labor at Engine House | 88 26 | |
| Repairs on engine and boilers | 622 39 | |
| Pumping, wages, coal, oil, waste, &c. | 5,256 19 | |
| Stable, wages, hay, grain, repairs, &c. | 705 39 | |
| | | $11,806 |

### CONSTRUCTION.

| | | |
|---|---|---|
| Distributing mains, hydrants and gates | $1,759 15 | |
| Services and court mains | 4,469 63 | |
| Land at Birch Pond | 15,614 16 | |
| Workshop and Stable | 82 89 | |
| Meters | 53 71 | |
| | | $21,979 |
| | | $33,786 |

## TOTAL EXPENDITURES TO JANUARY 1st, 1877.

| | | |
|---|---|---|
| Breed's Pond, land and buildings | $30,305 91 | |
| Birch Pond and land | 42,784 90 | |
| Pipe conduit and right of way | 43,785 93 | |
| Reservoir and land | 131,482 30 | |
| Force main and land | 24,614 00 | |
| Engine House and land | 55,112 79 | |
| Engines and boilers | 63,444 72 | |
| Distributing mains, hydrants and gates | 454,966 06 | |
| Services and court mains | 97,535 57 | |
| Meters, covers, &c. | 4,243 82 | |
| Workshop and Stable | 1,696 65 | |
| Engineering | 8,464 99 | |
| | | $958,437 |

### CREDIT.

| | |
|---|---|
| By amount received for extra pipe, labor, &c. | $27,886 |
| Total net expenditure | $930,551 |

## STATEMENT

SHOWING THE NUMBER OF FAMILIES, STORES, FACTORIES, &C., SUPPLIED WITH CITY WATER, WITH THE AMOUNT OF REVENUE RECEIVED DURING THE YEAR 1876.

| | | | |
|---|---|---|---|
| 3,633 | Families | $27,803 | 55 |
| 71 | Boarding Houses | 733 | 00 |
| 4 | Hotels | 247 | 68 |
| 241 | Stores | 1,172 | 00 |
| 44 | Offices | 377 | 00 |
| 21 | Restaurants and Saloons | 132 | 00 |
| 158 | Stables | 1,103 | 50 |
| 30 | Stationery Steam Engines | 3,348 | 79 |
| 146 | Factories and Steam Engines | 4,409 | 58 |
| 3 | Railroads | 1,665 | 35 |
| 4 | Steam Fire Engine and Hose Houses | 90 | 00 |
| 29 | School Houses | 522 | 00 |
| 11 | Churches | 112 | 00 |
| 9 | Public Halls | 297 | 87 |
| 8 | Printing Offices and Engines | 67 | 00 |
| 20 | Greenhouses | 122 | 00 |
| 7 | Bakeries | 60 | 75 |
| 8 | Barber Shops | 129 | 00 |
| 4 | Planing Mills | 492 | 87 |
| 7 | Machine and Blacksmith Shops | 110 | 00 |
| 7 | Markets | 68 | 00 |
| 3 | Banks | 37 | 00 |
| 5 | Photographers | 50 | 00 |
| 11 | Fountains | 77 | 25 |
| 956 | Hand Hose | 3,900 | 00 |
| 3 | Motors | 70 | 27 |
| 1 | City Hall | 200 | 00 |
| 1 | Post Office | 10 | 00 |
| 1 | Almshouse | 46 | 00 |
| 2 | Laundries | 75 | 93 |
| 1 | Foundry | 18 | 00 |
| 362 | Fire Hydrants and 4 Reservoirs | 10.000 | 00 |
| | For watering streets | 2,359 | 25 |
| | For building purposes | 94 | 50 |
| | For filling cisterns and all other purposes | 87 | 48 |
| | | $60,090 | 12 |

# STATEMENT

## SHOWING THE NUMBER AND KIND OF FIXTURES CONTAINED WITHIN THE PREMISES OF WATER TAKERS TO DECEMBER 31ST, 1876, COMPARED WITH THE PREVIOUS YEAR.

| Kind of Fixture. | 1875. | 1876. | Increase. | Decrease. |
|---|---|---|---|---|
| Faucets . . . . . . . . . . . . . . | 6,582 | 6,923 | 341 | |
| Bath Tubs . . . . . . . . . . . . | 342 | 371 | 29 | |
| Water Closets—pan . . . . . . . | | 880 | | |
| Water Closets—hopper . . . . . | | 58 | | |
| Water Closets—self-acting, hopper | | 75 | | |
| Water Closets, total . . . . . . . | 967 | 1,013 | 46 | |
| Hand Hose . . . . . . . . . . . . | 1,080 | 956 | | 124 |
| Totals . . . . . . . . . . . . . | 8,971 | 9,263 | 292 | |

## STATEMENT

SHOWING THE YEARLY REVENUE OF THE WATER DEPARTMENT, SINCE THE FIRST INTRODUCTION OF WATER INTO THE CITY, IN 1871.

| | |
|---|---|
| From October 1st, 1871, to January 1st, 1872 . . . . . . . . . | $8,989 00 |
| From January 1st, 1872, to January 1st, 1873 . . . . . . . . . | 27,568 16 |
| From January 1st, 1873, to January 1st, 1874 . . . . . . . . . | 47,992 61 |
| From January 1st, 1874, to January 1st, 1875 . . . . . . . . . | 53,545 61 |
| From January 1st, 1875, to January 1st, 1876 . . . . . . . . . | 52,553 26 |
| From January 1st, 1876, to January 1st, 1877 . . . . . . . . . | 60,867 12 |
| Total receipts for water . . . . . . . . . . . . . . . . . . . | $251,515 76 |

Respectfully submitted.

DANIEL WALDEN, Clerk.

*Lynn*, *Jan.* 5, 1877.

## STATEMENT

### SHOWING THE CLASSES OF PREMISES TO WHICH METERS ARE TACHED.

| Name. | Class. | Size. | | | |
|---|---|---|---|---|---|
| | | ⅝ | ¾ | 1 | 1½ |
| Eastern Railroad Company | | | | 1 | |
| B. R. B. and L. Railroad Company | | | 1 | | |
| L. and B. Railway Company | | | | 1 | |
| P. P. Tapley & Co. | Engine. | | | 1 | |
| R. W. Drown & Son | do | | 1 | | |
| Charles G. Clark | do | | | 1 | |
| Blaney Bros. | do | | | 1 | |
| A. B. Martin | do | | | 1 | |
| P. Lennox & Co | do | | | 1 | |
| S. M. Bubier | do | | | 1 | |
| I. Newhall | do | | | 1 | |
| Pevear & Co. | do | | | 1 | |
| A. E. Mullen | do | | | 1 | |
| Exchange Engine Company | do | | | 1 | |
| Swain & Fuller | do | 1 | | | |
| J. N. Buffum & Co. | do | | | 1 | |
| S. O. Breed | do | | | | 1 |
| F. B. Mower & Co. | do | | 1 | | |
| A. T. Goodwin | do | 1 | | | |
| S. M. Bubier | do | | | 1 | |
| J. Wooldredge | do | | | 1 | |
| A. T. Goodwin | do | 1 | | | |
| Central Power Company | do | 1 | | | |
| Baldwin & Silliman | do | | 1 | | |
| Keene Bros. | do | | | 1 | |
| W. A. Kelley & Son | do | | | 1 | |
| Bay State Wheel Company | do | | | 1 | |
| J. T. Moulton | do | 1 | | | |
| J. Donallan & Son | Factory. | | | 1 | |
| Eugene Barry | do | | 1 | | |
| Shute & Faulkner | do | | | 1 | |
| M. Norris & Son | do | | | 1 | |
| Bennett & Barnard | do | | 1 | | |
| Charles B. Tebbetts | do | | | 1 | |
| W. L. Haskell & Co. | do | 1 | | | |
| I. M. Attwill | do | 1 | | | |
| A. M. & J. H. Preble | do | 1 | | | |
| A. M. Wooldredge | do | | | 1 | |
| *Carried forward* | | 8 | 6 | 32 | 1 |

[STATEMENT SHOWING THE CLASSES OF PREMISES TO WHICH METERS ARE ATTACHED—*Continued.*]

| Name. | Class. | Size. | | | | |
|---|---|---|---|---|---|---|
| | | ⅝ | ¾ | 1 | 1½ | 2 |
| *Brought forward* | | 8 | 6 | 23 | 1 | |
| L. S. Johnson | Factory. | | | 1 | | |
| B. Dupar & Co. | do | | | | | |
| J. Davis & Co. | do | | | | | |
| J. Doherty & Co. | do | | | | | |
| W. Claflin | do | | | | | |
| Mower Bros. | do | | | | | |
| B. F. Doak & Co. | do | | 1 | | | |
| F. W. Breed | do | | 1 | | | |
| B. F. Spinney | do | | | | | |
| P. P. Sherry | do | | | | | |
| Chas. Buffum | do | | | | | |
| F. B. Mower | do | | | | | |
| Hanley & Eagan | do | 1 | | | | |
| Geo. W. Clark | do | 1 | | | | |
| Spinney & Caldwell | do | 1 | | | | |
| Pierce & Ellis | do | 1 | | | | |
| E. F. Bancroft & Co. | do | | | | | |
| J. J. Grover | do | | | | | |
| Jerome Ingalls | do | | | 1 | | |
| C. H. Bacheller & Co. | do | | | | | |
| T. C. Murphy | | | | | | |
| J. F. Davis | do | | | | | |
| Porter & Whittle | | | | | | |
| Bartlett & Doak | do | 1 | | | | |
| Danforth & Hoyt | do | 1 | | | | |
| J. N. Smith | do | 1 | | | | |
| John Dougherty | do | 1 | | | | |
| C. B. Lancaster | do | 1 | | | | |
| C. H. Aborn | do | 1 | | | | |
| Breed, Dole & Co. | do | | 1 | | | |
| T. P. Richardson & Co. | do | | 1 | | | |
| Essex Co-Operative Company | do | | 1 | | | |
| George Pecker | do | 1 | | | | |
| Geo. W. Downing | do | 1 | | | | |
| John Mahon & Son | do | | | 1 | | |
| Norton, Breed & Wells | do | 1 | | | | |
| Freed & Doak | do | | | 1 | | |
| C. A. Coffin | do | | | 1 | | |
| C. A. Sweetser | do | | | 1 | | |
| J. T. Moulton | do | | | 1 | | |
| Morgan & Dore | do | | | 1 | | |
| W. H. Holt | do | | 1 | | | |
| E. W. & C. F. Mower | do | | | 1 | | |
| E. H. Newhall | do | | | | | |
| Purinton & Newhall | do | 1 | | | | |
| Kimball Bros. | do | 1 | | | | |
| Burnham & Lewis | do | 1 | | | | |
| C. B. Clough | do | 1 | | | | |
| *Carried forward* | | 36 | 14 | 32 | 1 | 2 |

[STATEMENT SHOWING THE CLASSES OF PREMISES TO WHICH METERS ARE ATTACHED—*Concluded.*]

| Name. | Class. | Size. | | | | |
|---|---|---|---|---|---|---|
| | | ⅝ | ¾ | 1 | 1 | |
| *Brought forward* | | 36 | 14 | 32 | | |
| Lewis & Collyer | Factory. | 1 | | | | |
| Odd Fellows' Hall | Building. | | | 1 | | |
| S. S. Ireson | do | | 1 | | | |
| S. M. Bubier | do | | | 1 | | |
| A. C. Blethen | do | | 1 | | | |
| Geo. B. French | A. Music | | | 1 | | |
| A. E. Mower | Stable. | 1 | | | | |
| A. D. Wallace | do | 1 | | | | |
| W. L. Selman | do | 1 | | | | |
| A. B. Breed | do | 1 | | | | |
| Kertland House | Hotel. | 1 | | | | |
| C. R. Blake | Laundry. | 1 | | | | |
| W. J. Windram | Motor. | | | 1 | | |
| G. H. Whipple | Stch. Shp | | | | | |
| B. J. Berry | Dwelling | | | | | |
| Total, 100 | | 45 | 16 | 36 | 1 | 2 |

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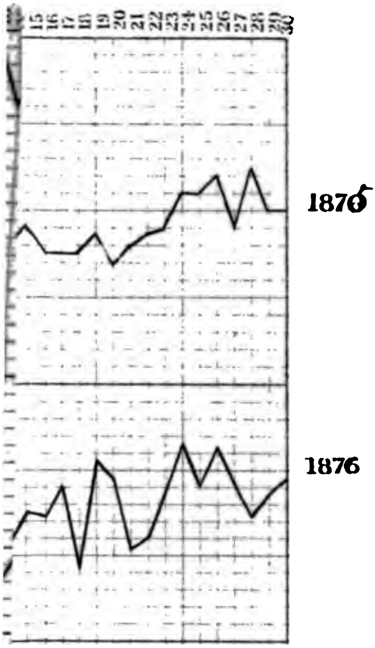

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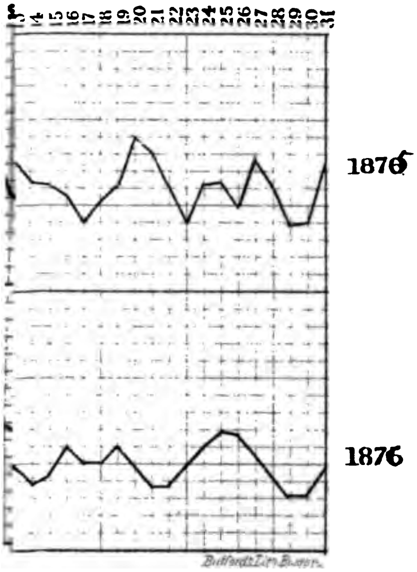


Bufford's Lith. Boston.

# Report of the Superintendent.

*Hon. Edwin Walden, President of the Public Water Board :*

I have the honor to present, herewith, the Annual Report of the Superintendent for the year ending December 21st, 1876 :

## PONDS.

The heavy rains of last spring filled both ponds to their full capacity, and, for the first time since Birch Pond was built, the water flowed over the flash-boards at the waste weir. There was a small waste at both ponds for several days, amounting, in the aggregate, to 20,500,000 gallons.

Soon after the extreme hot weather of the summer set in, it was discovered that the water from Birch Pond had a disagreeable taste and smell, while the water from Breed's Pond was perfectly sweet and good. The water of Birch Pond was immediately shut off from the pump-well, and the city supplied entirely from Breed's Pond during the remainder of the summer. As soon as the weather began to grow cool the water in Birch Pond began to improve, both in taste and color, very rapidly. The supply to the city has been taken entirely from that pond for the last two months, and barring a very slight color, which will probably entirely disappear in another year or two, it is doubtful if any city in the State is supplied with purer or more wholesome water.

The heavy rains of the autumn have replenished the ponds so that we have an increase in the amount stored, over that stored last year at the same time, of four feet three inches in Breed's Pond, and one foot in Birch Pond. The brooks flowing into the ponds have been cleared, Breed's Pond has been surveyed and contoured, and all necessary repairs have been made at both ponds. The rainfall has been above the average for this vicinity. The total yield of the ponds, including the amount wasted and the surplus in store, has been equal to 39.8 per cent. of the rainfall—or 17.94 inches over the total drainage area, exclusive of water surfaces.

There are a number of buildings belonging to the Breed's Pond property, for which the department has no use. They are unoccupied, and going to decay. It would be for the interest of the city if they could be sold.

## RESERVOIR.

During the heavy storms of last spring the wall on the inside slope of the Reservoir was badly damaged at the southerly end, near the Gate House, by being undermined by the wash of the water. The wall has since been re-laid, the damage thoroughly repaired, and the bank at the foot of the wall pitched with stone for several feet below the wall, to prevent a like occurrence in future. The top of the bank and the road around the Reservoir have been kept clean and in good condition. The outside slope will hardly raise weeds, and cannot be much improved until it is covered with a good coating of loam.

The road to the Reservoir, which was almost impassable, has been repaired and put in good condition.

## PUMPING STATION.

The Engine House has required but slight repairs. The grounds are in bad condition, and cannot be improved until they are fenced and graded, a work which should be done the coming spring.

The engine is in good condition, and under the management of Mr. Messinger continues to show the same economy in fuel that it has shown in previous years. On the 12th of March the plate for the suction-valves to the pump was broken, thus instantly relieving the engine of its load. The prompt action of the Engineer, and the admirable manner in which the engine is regulated by the governor, prevented further damage from being done. A new valve plate, much heavier than the old one, was procured from Philadelphia with as little delay as possible, and replaced by the Engineer, assisted by our own men, and the engine started up again on the first of April. While the repairs were going on the supply of water to the city was kept up by running the small Duplex Pump, day and night.

## PIPES.

e main is in good condition. There have been upon it for the year. The distributing mains in good order. One hundred and twenty-three o occurred, most of them in joints. There was at in Oxford street, caused by the pipe being some time before, in putting in a private sewer. ributing mains have been extended by the ad- f 1,221 feet of 4-inch pipe, and [illegible] feet of pipe, laid in courts. Four 4-inch gates and two tes have been set in connection with the ex- f pipe, and one fire hydrant. Two hydrants n broken and replaced by new ones, and two n changed to more convenient locations. All nts and gates have been examined, and are be- be in good condition for use. Twenty-five gate- d four service-boxes were found decayed, and n replaced by new ones. Two hundred and two nd three stand-pipes for water-carts, have been s year, of a total length of 8,361 feet; making length of service pipe laid in the city 27 miles. t.

ed please find the usual tables; also Diagrams, the rainfall, and the height of the ponds, for nth, and the consumption of water for each day, years 1875 and 1876. They may be found or comparison.

# TABLE I.

## Engine Record for the Year Ending December 31, 1876.

| Month. | Number of Pumping days. | Average pumping time per day. | | Total pumping time per month. | | Total number of Revolutions per month. | Average Revolutions per minute. | Coal Consumed. | | | | Ashes and cinders. | Ashes and cinders. | Total number of gallons pumped per month, allowing 4 per cent. for loss of action in the pump. | Average number of gallons pumped into the reservoir per lb. coal. | Average number of gallons raised 100 feet high per pound of coal. | Average head against the pump. | Average duty in pounds of water raised one foot high per 100 lbs. of coal, for total coal consumed, no deduction made for ashes and cinders. | Gallons Oil. | Lbs. Waste. | Coal used for heating. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Raising steam. | Pumping. | Banking. | Total. | | | | | | | | | | |
| | Dys | H. | M. | H. | M. | Revo'ns. | Rev. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | p.ct. | Gallons. | Galls. | Galls. | Feet. | Lbs. | | | Lbs. |
| January ....... | 9 | 15 | 12 | 136 | 45 | 153,172 | 18.66 | 7,900 | 36,300 | 1,500 | 45,700 | 5,185 | 11.34 | 28,574,236 | 625.25 | 1,035.77 | 165.66 | 89,935,509 | 3 | 6 | 13,100 |
| February ...... | 9 | 15 | 17 | 137 | 30 | 155,033 | 18.79 | 7,800 | 37,100 | 1,500 | 46,400 | 5,537 | 11.93 | 28,921,406 | 623.30 | 1,028.72 | 165.05 | 89,323,631 | 4 | 6 | 12,450 |
| March ......... | 5 | 13 | 41 | 68 | 25 | 75,670 | 18.43 | 4,500 | 18,250 | 1,200 | 23,950 | 2,789 | 11.79 | 14,116,238 | 596.88 | 990.58 | 165.96 | 84,933,465 | 4 | 8 | 6,600 |
| March (Duplex) | 20 | 22 | 54 | 458 | — | 1,589,220 | 57.83 | | 163,500 | | 163,500 | 21,033 | 13.63 | 19,070,640 | | | | | | | |
| April .......... | 12 | 13 | 19 | 159 | 50 | 175,042 | 18.25 | 9,000 | 42,050 | 2,100 | 53,150 | 8,448 | 15.90 | 32,654,085 | 614.37 | 1,018.50 | 165.78 | 88,428,356 | 5 | 8 | 3,600 |
| May ........... | 7 | 15 | 15 | 106 | 45 | 118,735 | 18.54 | 5,100 | 28,400 | 1,200 | 34,700 | 3,112 | 8.97 | 22,150,014 | 638.33 | 1,052.98 | 164.96 | 91,427,835 | 3 | 7 | |
| June........... | 15 | 13 | 59 | 209 | 55 | 229,532 | 18.22 | 11,900 | 52,800 | 3,000 | 67,700 | 9,190 | 13.57 | 42,819,194 | 632.48 | 1,041.67 | 164.70 | 90,451,178 | 7 | 12 | |
| July ........... | 16 | 14 | 13 | 227 | 35 | 233,919 | 17.10 | 10,300 | 52,250 | 3,200 | 65,750 | 8,540 | 12.98 | 43,637,589 | 665.21 | 1,101.72 | 165.63 | 95,446,283 | 8 | 12 | |
| August ........ | 19 | 12 | 23 | 235 | 15 | 204,187 | 14.46 | 10,100 | 49,500 | 3,000 | 62,600 | 7,720 | 12.33 | 38,091,085 | 608.48 | 1,002.29 | 164.72 | 87,027,407 | 7 | 10 | |
| September..... | 12 | 14 | 48 | 177 | 40 | 200,081 | 18.77 | 9,600 | 47,300 | 2,400 | 59,300 | 6,130 | 10.34 | 37,325,110 | 629.42 | 1,042.57 | 165.64 | 90,519,143 | 5 | 10 | |
| October........ | 9 | 15 | 36 | 138 | 25 | 153,636 | 18.49 | 7,800 | 36,700 | 1,500 | 46,000 | 4,860 | 10.56 | 28,600,796 | 623.06 | 1,034.00 | 165.95 | 89,780,847 | 5 | 9 | |
| November ..... | 8 | 15 | 01 | 120 | 10 | 133,642 | 18.53 | 7,300 | 32,300 | 1,200 | 40,800 | 4,330 | 10.61 | 24,930,915 | 611.05 | 1,018.62 | 166.7 | 88,391,122 | 4 | 8 | 3,000 |
| December ..... | 10 | 15 | 22 | 153 | 40 | 171,610 | 18.61 | 9,500 | 41,150 | 1,500 | 52,150 | 5,750 | 11.02 | 32,013,845 | 613.88 | 1,020.39 | 166.23 | 88,590,918 | 5 | 12 | 12,500 |
| Totals and Avs. | 151 | 15 | 22 | 2329 | 55 | | | 100,800 | 637,600 | 23,300 | 761,700 | 92,624 | 12.31 | 392,965,153 | | | 165.58 | 89,861,891 | 60 | 108 | 51,250 |

## COST OF PUMPING WITH BOTH ENGINES.

| | | |
|---|---|---|
| 761,700 lbs. of coal, at an average price of $6.64 per ton | $2,529 | 61 |
| 12½ cords of pine wood, at $7 per cord | 87 | 50 |
| 51,250 lbs of coal, for heating, average price, $6.70 per ton | 171 | 69 |
| Lighting, $23.50 ; sundries, $99.10 | 122 | 60 |
| Oil, waste and packing | 172 | 02 |
| Repairs to Engine and Boilers | 622 | 39 |
| Wages of Engineer and Fireman, and extra labor | 1,938 | 00 |
| | $5,643 | 81 |

| | |
|---|---|
| Cost of raising one million gallons into the Reservoir | $14.36$\frac{8}{100}$ |
| Cost of raising one million gallons one foot high | 0.08$\frac{67}{100}$ |

# TABLE II.

## SHOWING THE DUTY OF THE LEAVITT ENGINE FOR THE YEAR 1876, WITH THE COST OF PUMPING.

| Month, | Number of Pumping days. | Average pumping time per day. | | Total pumping time per month. | | Total number of Revolutions per month. | Average Revolutions per minute. | Coal Consumed. | | | | Ashes and cinders. | Ashes and cinders. | Total number of gallons pumped per month, allowing 4 per cent. for loss of action in the pump. | Average number of gallons pumped into the reservoir per lb. coal. | Average number of gallons raised 100 feet high per pound of coal. | Average head against the pump. | Average duty in pounds of water raised one foot high per 100 lbs. of coal, for total coal consumed, no deduction made for ashes and cinders. | Average duty in pounds of water raised one foot high, per 100 lbs. of coal, for totol coal consumed, the ashes and cinders deducted. | Average duty calculated on the coal consumed while pumping, no deduction made for ashes and cinders. | Average duty calculated on the coal consumed while pumping, ashes and cinders deducted. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Raising steam. | Pumping. | Banking. | Total. | | | | | | | | | | |
| | Dys | H. | M. | H. | M. | Revo'ns. | Rev. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | p.ct. | Gallons. | Galls. | Galls. | Feet. | Lbs. | Lbs. | Lbs. | Lbs. |
| January .. | 9 | 15 | 12 | 136 | 45 | 153,172 | 18.66 | 7,900 | 36,300 | 1,500 | 45,700 | 5,185 | 11.34 | 28,574,236 | 625.25 | 1,035.77 | 165.66 | 89,935,509 | 101,445,212 | 113,224,319 | 127,712,783 |
| February . | 9 | 15 | 17 | 137 | 39 | 155,033 | 18.79 | 7,800 | 37,100 | 1,500 | 46,400 | 5,537 | 11.93 | 28,921,406 | 623.30 | 1,028.72 | 165.05 | 89,323,631 | 101,427,122 | 111,714,73 | 126,851,422 |
| March .... | 5 | 13 | 41 | 68 | 25 | 75,670 | 18.43 | 4,500 | 18,250 | 1,200 | 23,950 | 2,789 | 11.79 | 14,116,238 | 596.88 | 990.58 | 165.96 | 84,933,465 | 96,127,664 | 111,460,630 | 126,140,240 |
| April ..... | 12 | 13 | 19 | 159 | 50 | 175,042 | 18.25 | 9,000 | 42,050 | 2,100 | 53,150 | 8,448 | 15.90 | 32,654,085 | 614.37 | 1,018.50 | 165.78 | 88,428,356 | 105,139,974 | 111,770,919 | 132,895,073 |
| May ...... | 7 | 15 | 15 | 106 | 45 | 118,735 | 18.54 | 5,100 | 28,400 | 1,200 | 34,700 | 3,112 | 8.97 | 22,150,014 | 638.33 | 1,052.98 | 164.96 | 91,427,835 | 100,435,162 | 111,709,362 | 122,714,807 |
| June...... | 15 | 13 | 59 | 209 | 55 | 229,532 | 18.22 | 11,900 | 52,800 | 3,000 | 67,700 | 9,190 | 13.57 | 42,819,194 | 632.48 | 1,041.67 | 164.70 | 90,451,178 | 104,658,088 | 115,976,226 | 134,191,149 |
| July ...... | 16 | 14 | 13 | 227 | 35 | 233,919 | 17.10 | 10,300 | 52,250 | 3,200 | 65,750 | 8,540 | 12.98 | 43,637,589 | 665.21 | 1,101.72 | 165.63 | 95,446,283 | 109,692,224 | 120,107,045 | 138,034,337 |
| August ... | 19 | 12 | 23 | 235 | 15 | 204,187 | 14.46 | 10,100 | 49,500 | 3,000 | 62,600 | 7,720 | 12.33 | 38,091,085 | 608.48 | 1,002.29 | 164.72 | 87,027,407 | 99,269,600 | 110,058,903 | 125,539,582 |
| September | 12 | 14 | 48 | 177 | 40 | 200,081 | 18.77 | 9,600 | 47,300 | 2,400 | 59,300 | 6,130 | 10.34 | 37,325,110 | 629.42 | 1,042.57 | 165.64 | 90,519,143 | 100,955,147 | 113,483,831 | 126,56[illegible],514 |
| October... | 9 | 15 | 36 | 138 | 25 | 153,630 | 18.49 | 7,800 | 36,700 | 1,500 | 46,000 | 4,860 | 10.56 | 28,660,796 | 623.06 | 1,034.00 | 165.95 | 89,780,847 | 100,386,946 | 112,531,852 | 125,823,983 |
| November | 8 | 15 | 01 | 120 | 10 | 134,642 | 18.53 | 7,300 | 32,300 | 1,200 | 40,800 | 4,330 | 10.61 | 24,930,915 | 611.05 | 1,018.62 | 166.7 | 88,391,122 | 98,885,598 | 111,651,943 | 124,908,484 |
| December | 10 | 15 | 22 | 153 | 40 | 171,610 | 18.61 | 9,500 | 41,150 | 1,500 | 52,150 | 5,750 | 11.02 | 32,013,845 | 613.88 | 1,020.39 | 166.23 | 88,590,918 | 99,569,318 | 112,272,573 | 126,185,136 |
| Tot. & av's | 131 | 14 | 17 | 1871 | 55 | 2,004,259 | 17.85 | 100,800 | 474,100 | 23,300 | 598,200 | 71,591 | 11.97 | 373,894,513 | 625.35 | 1,035.45 | 165.58 | 89,861,891 | 102,078,360 | 113,384,061 | 128,708,290 |

## COST OF PUMPING WITH LEAVITT ENGINE.

| | |
|---|---|
| 598,200 lbs. of coal, at an average price of $6.59 per ton | $1,971 07 |
| 12½ cords of pine wood, at $7 per cord | 87 50 |
| 51,250 lbs. of coal, for heating, average price $6.70 per ton | 174 69 |
| Lighting, $23.50 ; sundries, $99.10 | 122 60 |
| Oil, waste, packing, &c. | 172 02 |
| Repairs to Engine and Boilers | 618 07 |
| Wages of Engineer and Fireman, and extra labor | 1,900 00 |
| | $5,042 95 |

| | |
|---|---|
| Cost of raising one million gallons into the reservoir | $13 48$\frac{76}{100}$ |
| Cost of raising one million gallons one foot high | 0 08$\frac{11}{100}$ |

# TABLE II.

## SHOWING THE DUTY OF THE LEAVITT ENGINE FOR THE YEAR 1876, WITH THE COST OF PUMPING.

| | Number of Pumping days. | Average pumping time per day. | | Total pumping time per month. | | Total number of Revolutions per month. | Average Revolutions per minute. | Coal Consumed. | | | | Ashes and cinders. | Ashes and cinders. | Total number of gallons pumped per month, allowing 4 per cent. for loss of action in the pump. | Average number of gallons pumped into the reservoir per lb. coal. | Average number of gallons raised 100 feet high per pound of coal. | Average head against the pump. | Average duty in pounds of water raised one foot high per 100 lbs. of coal, for total coal consumed, no deduction made for ashes and cinders. | Average duty in pounds of water raised one foot high, per 100 lbs. of coal, for totol coal consumed, the ashes and cinders deducted. | Average duty calculated on the coal consumed while pumping, no deduction made for ashes and cinders. | Average duty calculated on the coal consumed while pumping, ashes and cinders deducted. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Raising steam. | Pumping. | Banking. | Total. | | | | | | | | | | |
| Month, | Dys | H. | M. | H. | M. | Revo'ns. | Rev. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | p.ct. | Gallons. | Galls. | Galls. | Feet. | Lbs. | Lbs. | Lbs. | Lbs. |
| January .. | 9 | 15 | 12 | 136 | 45 | 153,172 | 18.66 | 7,900 | 36,300 | 1,500 | 45,700 | 5,185 | 11.34 | 28,574,236 | 625.25 | 1,035.77 | 165.66 | 89,935,500 | 101,445,212 | 113,224,319 | 127,712,783 |
| February . | 9 | 15 | 17 | 137 | 39 | 155,033 | 18.77 | 7,800 | 37,100 | 1,500 | 46,400 | 5,537 | 11.93 | 28,921,406 | 623.30 | 1,028.72 | 165.05 | 89,323,631 | 101,427,122 | 111,714,73[illegible] | 126,851,422 |
| March .... | 5 | 13 | 41 | 68 | 25 | 75,670 | 18.43 | 4,500 | 18,250 | 1,200 | 23,950 | 2,789 | 11.79 | 14,116,238 | 596.88 | 990.58 | 165.96 | 84,933,465 | 96,127,664 | 111,460,630 | 126,149,240 |
| April ..... | 12 | 13 | 19 | 159 | 50 | 175,042 | 18.25 | 9,000 | 42,050 | 2,100 | 53,150 | 8,448 | 15.93 | 32,654,085 | 614.37 | 1,018.50 | 165.78 | 88,428,356 | 105,139,974 | 111,770,919 | 132,895,073 |
| May ...... | 7 | 15 | 15 | 106 | 45 | 118,735 | 18.54 | 5,100 | 28,400 | 1,200 | 34,700 | 3,112 | 8.97 | 22,150,014 | 638.33 | 1,052.98 | 164.96 | 91,427,835 | 100,435,162 | 111,709,362 | 124,714,807 |
| June...... | 15 | 13 | 59 | 209 | 55 | 229,532 | 18.22 | 11,900 | 52,800 | 3,000 | 67,700 | 9,190 | 13.57 | 42,819,194 | 632.48 | 1,041.67 | 164.70 | 90,451,178 | 104,658,088 | 115,976,226 | 134,191,149 |
| July ...... | 16 | 14 | 13 | 227 | 35 | 233,919 | 17.10 | 10,300 | 52,250 | 3,200 | 65,750 | 8,540 | 12.98 | 43,637,589 | 665.21 | 1,101.72 | 165.63 | 95,446,283 | 109,692,224 | 120,107,045 | 138,034,337 |
| August ... | 19 | 12 | 23 | 235 | 15 | 204,187 | 14.46 | 10,100 | 49,500 | 3,000 | 62,600 | 7,720 | 12.33 | 38,091,085 | 608.48 | 1,002.29 | 164.72 | 87,027,407 | 99,269,600 | 110,058,903 | 125,539,582 |
| September | 12 | 14 | 48 | 177 | 40 | 200,081 | 18.77 | 9,600 | 47,300 | 2,400 | 59,300 | 6,130 | 10.34 | 37,325,110 | 629.42 | 1,042.57 | 165.64 | 90,519,143 | 100,955,147 | 113,483,831 | 126,56[illegible],514 |
| October... | 9 | 15 | 36 | 138 | 25 | 153,636 | 18.49 | 7,800 | 36,700 | 1,500 | 46,000 | 4,860 | 10.56 | 28,660,796 | 623.06 | 1,034.00 | 165.95 | 89,780,847 | 100,386,946 | 112,531,852 | 125,823,983 |
| November | 8 | 15 | 01 | 120 | 10 | 133,642 | 18.53 | 7,300 | 32,300 | 1,200 | 40,800 | 4,330 | 10.61 | 24,930,915 | 611.05 | 1,018.62 | 166.7 | 88,391,122 | 98,885,598 | 111,651,943 | 124,908,484 |
| December | 10 | 15 | 22 | 153 | 40 | 171,610 | 18.61 | 9,500 | 41,150 | 1,500 | 52,150 | 5,750 | 11.02 | 32,013,845 | 613.88 | 1,020.39 | 166.23 | 88,590,918 | 99,569,318 | 112,272,573 | 126,185,136 |
| Tot. & av's | 131 | 14 | 17 | 1871 | 55 | 2,004,259 | 17.85 | 100,800 | 474,100 | 23,300 | 508,200 | 71,591 | 11.97 | 373,894,513 | 625.35 | 1,035.45 | 165.58 | 89,861,891 | 102,078,360 | 113,384,061 | 128,798,290 |

# TABLE IV.

## SHOWING THE DEPTH OF WATER IN THE PONDS FOR EACH WEEK DURING THE YEAR 1876.

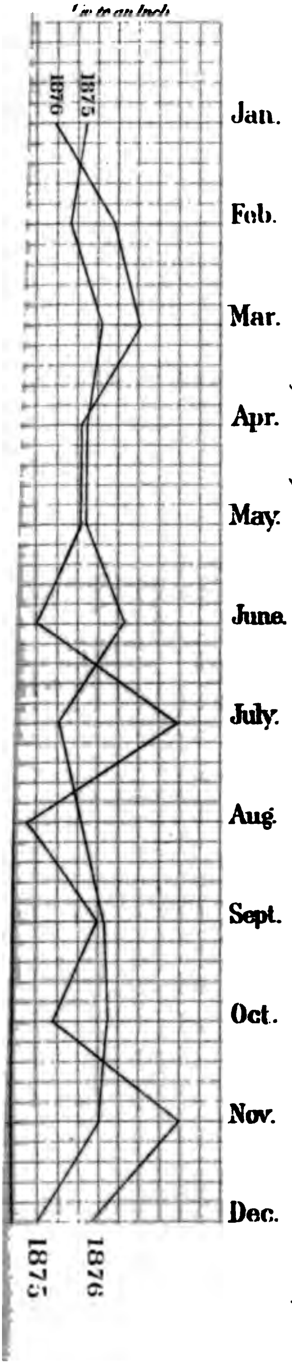
| Date. | | Breed's Pond. | | Birch Pond. | | Date. | | Breed's Pond. | | Birch Pond. | | Date. | | Breed's Pond. | | Birch Pond. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ft | In. | Ft | In. | | | Ft | In. | Ft | In. | | | Ft | In. | Ft | In. |
| Jan. | 3 | 9 | 4½ | 9 | 9 | May | 15 | 17 | 7 | 14 | 3 | Sept. | 25 | 9 | 0 | 12 | 2 |
| | 10 | 9 | 4 | 9 | 10 | | 22 | 17 | 5½ | 14 | 3½ | Oct. | 2 | 8 | 7½ | 12 | 1 |
| | 17 | 8 | 9 | 9 | 9½ | | 29 | 17 | 7½ | 14 | 4½ | | 9 | 8 | 0½ | 11 | 11 |
| | 24 | 8 | 8 | 9 | 9½ | June | 5 | 17 | 6½ | 14 | 4 | | 16 | 7 | 6 | 11 | 7 |
| | 31 | 9 | 10 | 9 | 10 | | 12 | 17 | 0 | 14 | 3½ | | 23 | 7 | 2 | 11 | 5 |
| Feb. | 7 | 8 | 5½ | 10 | 0½ | | 19 | 16 | 9 | 14 | 1 | | 30 | 7 | 1 | 11 | 1 |
| | 14 | 8 | 10 | 10 | 4 | | 26 | 16 | 2 | 13 | 9 | Nov. | 6 | 6 | 11½ | 10 | 10½ |
| | 21 | 10 | 5 | 10 | 10½ | July | 3 | 15 | 7 | 13 | 6½ | | 13 | 8 | 3½ | 11 | 1 |
| | 28 | 10 | 7½ | 10 | 10½ | | 10 | 14 | 10½ | 13 | 2 | | 20 | 9 | 1 | 10 | 10½ |
| Mar. | 6 | 10 | 9 | 10 | 10 | | 17 | 14 | 3½ | 13 | 0 | | 27 | 11 | 9 | 11 | 8 |
| | 13 | 11 | 1½ | 10 | 10½ | | 24 | 13 | 10 | 13 | 0 | Dec. | 4 | 12 | 3 | 11 | 6 |
| | 20 | 11 | 1½ | 10 | 11½ | | 31 | 13 | 9 | 13 | 2 | | 11 | 12 | 6½ | 11 | 4½ |
| | 27 | 13 | 11 | 12 | 8 | Aug. | 7 | 13 | 3 | 13 | 0 | | 18 | 12 | 10 | 11 | 3 |
| April | 3 | 15 | 5 | 13 | 1½ | | 14 | 12 | 10 | 12 | 10 | | 25 | 13 | 1 | 10 | 11½ |
| | 10 | 17 | 10 | 13 | 7 | | 21 | 12 | 3 | 12 | 8½ | | 31 | 13 | 4½ | 10 | 9 |
| | 17 | 17 | 10 | 13 | 11 | | 28 | 11 | 6 | 12 | 6 | | | | | | |
| | 24 | 17 | 8 | 14 | 0½ | Sept. | 4 | 10 | 10 | 12 | 4 | | | | | | |
| May | 1 | 17 | 7 | 14 | 0½ | | 11 | 10 | 1 | 12 | 2½ | | | | | | |
| | 8 | 17 | 9 | 14 | 1 | | 18 | 9 | 9 | 12 | 3 | | | | | | |

# TABLE V.

## SHOWING THE RAINFALL FOR THE YEAR 1876.

| Day of the Month. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | .50 | | | | | | | | .43 | .03 | |
| 2 | | | | | | | .07 | | .43 | | | |
| 3 | | | | 2.68 | | | .49 | | | | .09 | |
| 4 | | .58 | | | .10 | .50 | | | | | | |
| 5 | .04 | | | | .05 | | | | .07 | .10 | | |
| 6 | | .26 | | | | | | | | .08 | | |
| 7 | | | | | .12 | | | .07 | | | 2.44 | |
| 8 | .33 | | | | 1.44 | | | | | | .09 | |
| 9 | .33 | .46 | | | | | | | | | | .44 |
| 10 | | | | | .14 | | .14 | | | | .54 | |
| 11 | | .17 | | | | | .43 | | | | .10 | .64 |
| 12 | | | | | .09 | | | | | | .74 | |
| 13 | | | .37 | | | .09 | | | | | | |
| 14 | | 1.82 | | | | | | | | | | |
| 15 | | | | | .03 | | | | 2.07 | .36 | .04 | |
| 16 | | | .78 | | | | | | .12 | | | |
| 17 | .10 | | | .19 | | | | .25 | .04 | | | |
| 18 | .03 | | | | .30 | | .52 | | .10 | | | 1.34 |
| 19 | .03 | | | | | | | | | | | |
| 20 | | | 1.79 | | .10 | | | .23 | | | 3.72 | |
| 21 | | | | .12 | | .10 | | | | | | .04 |
| 22 | | .42 | | | 1.04 | .09 | | | .08 | .27 | .10 | .38 |
| 23 | .20 | | | .08 | | | 2.64 | | | .13 | | |
| 24 | | | | | | | | | .76 | .30 | | |
| 25 | | | 2.45 | | | .10 | | | | | | |
| 26 | | | | | | | | | | | | .01 |
| 27 | .47 | .19 | | | | .16 | | | | | .03 | |
| 28 | .20 | .32 | | .05 | | .03 | | | | | | |
| 29 | .10 | | .65 | | .10 | | | | | | | .79 |
| 30 | | | | .25 | | | 3.07 | | | | | |
| 31 | | | | | | | | | | | | |
| | 1.83 | 4.72 | 6.04 | 3.37 | 3.21 | 1.07 | 7.36 | .55 | 3.67 | 1.67 | 7.92 | 3.64 |

TOTAL RAINFALL FOR THE YEAR, 45.05 INCHES.



*Pounds on the first of each month.*

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TILDEN FOUNDATIONS.

# TABLE VI.

## SHOWING THE AMOUNT OF PIPE LAID IN 1876.

| NAMES OF STREETS. | | | SIZE OF PIPE IN INCHES. | | |
|---|---|---|---|---|---|
| Street. | From | To | 6 | 4 | 1½ |
| Newhall Court | Essex . . . . . | | 1-6 | 305 | |
| Newhall Place | Newhall Court | | | | 192.3 |
| Nahant Place . | Nahant . . . . | Extension . . . | | 239 | |
| Williams . . . | Chatham . . . | | 1-6 | 341 | |
| Empire . . . . | Essex . . . . . | Extension . . . | | 129.6 | |
| Friend St. Ct. . | Friend . . . . | | | 207 | |
| High Rock Ct. . | High Rock . . | | | | 155.8 |
| Chatham Ct. . | | | | | 146.4 |
| Totals . . . . | | | 3 | 1,221.6 | 494.3 |

| | |
|---|---|
| Total extension of pipe in 1876 . . . . . . | 1,728 ft. 9 in. |
| Previously laid . . . . . . . . . . . . . . | 48 miles, 3,381 ft. |
| Total amount of pipe laid to date . . . . . | 48 miles, 5,109 ft. |

## HYDRANT SET IN 1876.

| | |
|---|---|
| Nahant Place, 500 ft. east from Nahant Street . . . . . . . . . . . | 1 |
| Previously set . . . . . . . . . . . . . . . . . . . . . . . . . . . | 361 |
| Total number of Hydrants set to date . . . . . . . . . . . . . . . | 362 |

## TABLE VII.

### SHOWING THE NUMBER AND LOCATION OF GATES SET IN 1876.

| Street. | Location. | No. | In. |
|---|---|---|---|
| Friend St. Ct. | On the line of the S. side of Friend Street.<br>16 ft. west of the E. line of Friend St. Court. | 1 | 4 |
| Nahant Place. | 2 ft. east of the E. line of Nahant Street.<br>13 ft. 6 in. north of S. line of Nahant Place. | 1 | 4 |
| Newhall Ct. | 2 ft. 6 in. south of S. line of Essex Street.<br>11 ft. 10 in. east of W. line of Newhall Court. | 1 | 4 |
| Williams St. | On the line of the east side of Chatham Street.<br>12 ft. south from N. line of Williams Street. | 1 | 4 |
| High Rock Ct. | 5 ft. north of S. line of High Rock Street.<br>10 ft. east of W. line of High Rock Court. | 1 | 2 |
| Chatham Ct. | On the line of east side of Chatham Street.<br>12 ft. 8 in. north of S. line of Chatham Court. | 1 | 2 |
| Total . . . . | | 6 | |

Gates previously set . . . . . . . . . . . . . . . . . . . . . 319

Total, gates set . . . . . . . . . . . . . . . . . . . . . 325

# TABLE VIII.

SHOWING THE SERVICES LAID DURING THE YEAR 1876.

| Month. | Size of Pipe. | | | | | | Totals. | |
|---|---|---|---|---|---|---|---|---|
| | 2 inch. | | 1 inch. | | ¾ inch. | | | |
| | No. | Length. | No. | Length. | No. | Length. | No. | Length. |
| April . . . . | | | 5 | 349.6 | 21 | 787 | 26 | 1,136.6 |
| May . . . . | 1 | 29 | 1 | 41.2 | 19 | 335.8 | 21 | 405.10 |
| June . . . . | 1 | 29.2 | 2 | 146.5 | 29 | 1,033 | 32 | 1,208.7 |
| July . . . . | 1 | 43.6 | 2 | 133 | 19 | 810.8 | 22 | 987.2 |
| August . . . | | | 2 | 193 | 18 | 615.11 | 20 | 808.11 |
| September . | | | 1 | 102 | 29 | 1,098.3 | 30 | 1,200.3 |
| October . . . | | | 8 | 817.2 | 28 | 1,165.4 | 36 | 1,982.6 |
| November . | | | | | 15 | 445 | 15 | 445 |
| December . . | — | | | 93.6 | 3 | 93 | 3 | 186.6 |
| Totals . . . | 3 | 101.8 | 21 | 1,875.9 | 181 | 6,383.10 | 205 | 8,361.3 |

# TABLE IX.

## REPAIRS ON PIPES, GATES AND HYDRANTS, DURING THE YEAR 1876.

| Month. | Size of Pipe. | | | | | | | | | | Size of Gate. | | | | | | Hydrants. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 16 | 12 | 10 | 8 | 6 | 4 | 2 | 1½ | 1 | ¾ | 16 | 12 | 10 | 8 | 6 | 4 | |
| January . . . | 2 | | | 2 | 3 | 6 | | | 1 | 2 | | | | | | | 1 |
| February . . . | 3 | | | 1 | 3 | 1 | | | | | | | | | | | 6 |
| March . . . . | 8 | | | | | 1 | | | 1 | | | | | | | | 2 |
| April . . . . . | 3 | | | | 2 | | | | | | | 1 | | | | 1 | 13 |
| May . . . . . | 2 | | | 1 | | 2 | | | 1 | 3 | 1 | | | | | 3 | 5 |
| June . . . . . | | | | 1 | 1 | 4 | | 1 | 5 | | | | | | 1 | | 2 |
| July . . . . . | 1 | | | | 8 | 2 | 1 | | 2 | 2 | | | | | | | |
| August . . . . | | | | 3 | 3 | 6 | | 1 | 1 | 1 | | | | | | | 2 |
| September . . | | | | 1 | | 3 | | | 1 | | | | | | | | |
| October . . . | 2 | | 1 | 1 | 6 | | | | 1 | | | | | | | | |
| November . . | | 3 | | | 1 | | | | | | | | | | | 1 | |
| December . . | 1 | 1 | | | 4 | 4 | | | 3 | 2 | | | | | | | 2 |
| Totals . . . . | 22 | 4 | 1 | 10 | 28 | 29 | 1 | 2 | 16 | 10 | 1 | 1 | | | 1 | 5 | 33 |

Respectfully submitted.

DANIEL WALDEN,

SUPERINTENDENT.

840132

# SIXTH ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD

OF THE

# CITY OF LYNN,

FOR THE YEAR ENDING DEC. 31, 1877

LYNN:
RUFUS KIMBALL, PRINTER.
MUNROE STREET.
1878.

# TABLE IX.

## REPAIRS ON PIPES, GATES AND HYDRANTS, DURING THE YEAR 1876.

| Month. | Size of Pipe. | | | | | | | | | | Size of Gate. | | | | | | Hydrants. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 16 | 12 | 10 | 8 | 6 | 4 | 2 | 1½ | 1 | ¾ | 16 | 12 | 10 | 8 | 6 | 4 | |
| January . . . | 2 | | | 2 | 3 | 6 | | | 1 | 2 | | | | | | | 1 |
| February . . . | 3 | | | 1 | 3 | 1 | | | | | | | | | | | 6 |
| March . . . . | 8 | | | | | 1 | | | 1 | | | | | | | | 2 |
| April . . . . . | 3 | | | | 2 | | | | | | | 1 | | | | 1 | 13 |
| May . . . . . | 2 | | | 1 | | 2 | | | 1 | 3 | 1 | | | | | 3 | 5 |
| June . . . . . | | | | 1 | 1 | 4 | | 1 | 5 | | | | | | 1 | | 2 |
| July . . . . . | 1 | | | | 8 | 2 | 1 | | 2 | 2 | | | | | | | |
| August . . . . | | | | 3 | 3 | 6 | | 1 | 1 | 1 | | | | | | | 2 |
| September . . | | | | 1 | | 3 | | | 1 | | | | | | | | |
| October . . . | 2 | | 1 | 1 | 6 | | | | 1 | | | | | | | | |
| November . . | | 3 | | | 1 | | | | | | | | | | | 1 | |
| December . . | 1 | 1 | | | 4 | 4 | | | 3 | 2 | | | | | | | 2 |
| Totals . . . . | 22 | 4 | 1 | 10 | 28 | 29 | 1 | 2 | 16 | 10 | 1 | 1 | | | 1 | 5 | 33 |

Respectfully submitted.

DANIEL WALDEN,

SUPERINTENDENT.

840192

# SIXTH ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD

OF THE

# CITY OF LYNN,

FOR THE YEAR ENDING DEC. 31, 1877.

LENOX AND
NDATIONS

LYNN:
RUFUS KIMBALL, PRINTER.
MONROE STREET.
1878.

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# SIXTH ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD

OF THE

# CITY OF LYNN,

FOR THE YEAR ENDING DEC. 31, 1877.

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ss Exchange.

NN :
RUFUS KIMBALL, PRINTER,
MUNROE STREET.
1878.

# Report of the Public Water Board.

Agreeably to the requirements of the City Ordinance which provides for the establishing of the Water Department of the city, the Public Water Board hereby present to the City Council their report of the official acts and doings of the Board for the year 1877 :—

The Reports of the Clerk of the Board and of the Superintendent of the Works are hereto appended. These reports have been prepared from records and accounts so accurately kept and systematically arranged, and are so full and complete in the information they afford, that our duty would seem to be discharged if no word of comment accompanied their presentation.

We refer you to the Clerk's Report for statements showing the receipts and expenditures for the year, the total gross and net cost of the works to date, the annual increase in receipts from the time the department was established to the date of this Report, and the deficiency of income to meet the annual payments for interest and maintenance. Therein will also be found stated the number of supply pipes connected with the street mains, how many have been shut off and for what reason, the number of meters attached to the same, and other interesting information relating to the supply of water to consumers.

The Superintendent's Report furnishes satisfactory information as to the condition of the works, accurately notes the rainfall for the year and the rise and fall of the water in our storage reservoirs. The quantity of water received into the storage basins during the year, and the amount which could have been made available for use, are also given. A table, prepared with much labor and care, shows the duty performance of the pumping engine, with full record of data for determining the same. The daily and monthly averages of water consumption are also recorded, and other interesting facts, observed and collated by this industrious and painstaking officer, are reported. Especially do we invite perusal of the brief but very suggestive article contained in this report upon the capacity of the water supply of the city, and the liability to a short supply in a season of low rainfall.

## WATER SUPPLY.

The rainfall during the past year was unusually large, and the quantity of water received into the storage reservoirs was considerably in excess of the requirement for a full supply to all consumers. During the months of June, July, August and September, the water in the Birch Pond reservoir was again rendered unpalatable by the peculiar taste imparted to it by what is known as microscopic vegetable growth. The water stored in Breed's Pond was, fortunately, free from this cause of defilement. We were therefore able to supply the city for the entire year with water of excellent quality.

This minute vegetable growth, which at times affects so unfavorably the water in our storage basins, is not peculiar to this locality. The Reports received at this office in exchange for our own, make frequent mention of the appearance in the water sources of other towns and cities of this cause of contamination. Microscopists and chemists have been employed by different cities to report upon the character of water thus affected, and to examine into the conditions which develope the growth of these minute plants. Of the scientists who have been thus engaged no one appears to have been more painstaking and thorough in his examinations and analyses than Professor Nichols, of the Institute of Technology, Boston, whose report upon the subject we append to this notice :

MY DEAR SIR :—As I am often asked for information with reference to what is known about the nature and cause of the green material which during the summer time fills the waters of many of our ponds, I have written out somewhat at length what is the actual state of our information in the matter.

I take the liberty of sending you a copy of what I have written. I shall be very glad to receive any information or details as to the occurrence of similar growths in ponds with which I am not familiar, and being interested in various matters relating to water supply, I should esteem it a kindness if you would favor me with such reports as you may from time to time have at your disposal. I shall endeavor to reciprocate as far as I have opportunity.

The appearance to which I refer is due to a vegetable growth; not to the presence of particles of dead, decomposing or decayed vegetable matter from the sides or bottom of the pond, but to the enormous development of one or more of several species of microscopic plants. The individual plants are in some cases distinguishable by the naked eye, but their form and structure can be made out only by use of the microscope. The number of individuals is almost infinite, and under favorable conditions they increase with great rapidity; their presence gives a decidedly green, or greenish yellow tinge, to large bodies of water, and their death and decay often causes considerable offence to the sense of smell of those sojourning in the neighborhood, and to the sense of taste of those obliged to drink the water.

Yours, respectfully,

**WM. RIPLEY NICHOLS.**

*Mass. Inst. of Technology, Boston, Oct.* 1, 1877.

No natural water which is exposed to the air, whether in pond or river, is ever entirely free from vegetable growth, and to certain of those growths attention has been more frequently called of late, owing to the very considerable increase in the number of towns furnished with a supply of water taken from natural ponds of long standing, or from artificial reservoirs recently made, either by raising the level of a natural pond, or by damming some stream.

The non-professional and non-botanical observer might very likely divide the various plants found growing in the water into three classes: 1st, and most readily recognized as plants, are those commonly known as eel grass, pond-weed, pickerel-weed, lilies, etc., which have roots and leaves, and also, at the proper season, flowers; second, and less readily recognized as plants, are the confervoid growths,[1] as they are often called, of filamentous structure, grass-green, or in some cases bluish green in color, forming tangled masses readily removed from the water, and when so removed shrinking enormously in apparent bulk and drying away to a grayish or colorless mass, in some cases looking almost like coarse paper. Plants of this character grow in almost all reservoirs, or other bodies of water exposed to the light and air, both in still and running water. These plants either float in masses in the water or grow attached more or less firmly to the rocks and stones of the bottom of the pond or reservoir. By their growth they do no harm to the water in which they flourish, and as they are readily arrested by ordinary wire screens, or readily removed by rakes or scoop-nets, their presence causes no serious inconvenience in water used for town-supply. If detached and floating in the pond they readily drift to shore, so that when the ice is formed they are not likely to be frozen in and to injure the ice for the market.

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[1] These, as well as those mentioned below, belong to the class of cryptogamous (non-flowering) plants, which the botanists call *algæ*—plants which grow in the water, or in moist places, and usually contain chlorophyll (green coloring matter), or some allied substance. To their number and variety there is almost no end.

The third division of the non-professional would include those minute organisms which appear as greenish specs, or minute, straight or curved threads, diffused through the water, visible enough if a large quantity of water be looked at, but perhaps almost escaping notice in the small quantity which would be taken up in a single glass. If collected together as a scum, which often happens, especially on the windward shore of a pond, the scum is not coherent, is easily broken up, either by a wind setting in the opposite direction, by a shower of rain, or by artificial agitation. The appearance has been sometimes described as that of meal or fine dust scattered through the water.

While very many species of the minute *algæ* present this general appearance, as far as my own observation and information extends, the number of species which are known to increase to such a great extent as to completely fill the waters of ponds of many acrés area, and to cause sensible inconvenience, is comparatively small. The most common in this neighborhood (New England) seeming to be the *Clathrocystis æruginosa*, but certain plants referable to the *Nostochineæ* are not uncommon alone, or in company with the *Clathrocystis.*

The inconvenience caused by the presence of the plant is felt first by those who use the water for town supply, and, secondly, by those who cut ice upon the pond. While the plant is alive and growing there is little taste or odor given to the water, hardly noticeable if the water be iced. When the plants enter into the first stage of decay, the water acquires a peculiar taste and odor. Light and a certain degree of temperature are requisite for the normal growth of these algæ, and the decay often takes place in the mains and service pipes: it will not unfrequently happen that the water in a reservoir or pond will have almost no taste, while the water as delivered to consumers will have a decided taste. By the settling of the green growth to the bottom in a more or less decayed state, the ponds are generally (?) cleared before the cold weather sets in, but in several cases which have come under my observations the material floats up to the under surface of the ice, and is frozen into the ice, making it unmarketable. I am collecting data, but have arrived at no satisfactory conclusion as to the circumstances under which this does or does not occur, for it does not happen every year even in the same pond, and after summers of equally abundant growth.

Among the various questions which are often propounded with reference to the matter, are the following:—

1. What is the cause of the trouble?

2. Why do we (in this region) hear so much more about it than formerly?

3. Is it injurious to health?

4. Can anything be done to prevent it?

1. *The cause of the trouble.*

Although there is no doubt that the trouble is caused by minute vegetable organisms, of whose life history a good deal is known to botanists, various causes have been suggested for its appearance. By many it has been supposed to be a sort of fermentation, a process of purification. In some cases, this abundant appearance of the green matter has seemed to follow the apparent increase of sewage and other impurities discharged into the pond. I have within the last few years examined a great many ponds affected in this way, and cannot satisfy myself that there is any connection between such discharge of sewage and the growth of these algæ; the amount of soluble nitrogenous matter, of ammoniacal salts, of phosphates and of other mineral compounds necessary for their growth are everywhere present, and it would be unsafe to prophecy the security therefrom of any pond. Although it would seem that ponds recently made by flowing marshy or cultivated land were peculiarly liable to the trouble, especially if shallow, my observations have led me to make even this statement less emphatic than I was at first inclined.

Although these plants are not all killed by a considerable degree of cold, still they *thrive* only in warm weather. Observations on this point are incomplete, but such as I have been able to collect would seem to point to a temperature of 70° F., or thereabout, below which the trouble is not likely to begin; extended observations on this point are much needed.

I have been unable to satisfy myself that the presence of aquatic plants at the margins of the ponds has other effect than that of entangling and holding masses of scum, which if then exposed to a hot summer sun rapidly enter into decay.

Mr. Geo. W. Carpenter, of the Albany Water Works, has made the observation that in years when there is early in the season in his reservoirs a vigorous growth of certain *filamentous* algæ (which from the description probably are of some species of Spirogyra or Zygnema) there is not any growth of the finer algæ, which in other years cause more or less trouble. I have met with other instances where the same thing has seemed to obtain; on the other hand, I have often found *Spirogyra* and other filamentous plants growing at the same time with the *Clathrocystis*. In Horn Pond, near Boston, there is generally in the spring a large amount of a plant which to the eye seems, except in color, very like the filamentous algæ referred to,[1] and later in the season, for some years at least, there has been an abundant growth of the *Clathrocystis* and of an *Anabœna*.

*Why do we (in this region) hear so much more about this growth than formerly?*

One reason, at least, is to be found in the fact that the attention of more persons is called to the various ponds than formerly. It may be true, although hardly probable, that for the past five or six years there has been more of the growth in the aggregate than usual. There is no doubt that in the case of certain individual ponds there has been a decided increase; in other ponds there has been apparent decrease; others seem to be subject to irregular fluctuations in the amount from season to season.

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[1] This is the *Plectonema Wollei*, a plant of bluish green color, belonging to the order of *Nostochineæ*, described by Dr. Farlow in the Bulletin of the Bussey Institution, Vol. II (1876), p. 75.

It is also to be remarked that little is generally said by those in charge of Water Works with reference to such matters, as everything of the kind is apt to be exaggerated in the public prints, and often made capital of by political and other opponents, although the trouble may be entirely beyond the control of Water Board or Superintendent.

The earliest Water Report with which I am acquainted that shows any clear conception of the nature of the trouble is the Report of the Croton Water Board, New York, 1859. The Albany Water Report for the year 1865 contains a very full account of the trouble as there experienced. From the figure given of the plant, I infer it to be a species of *Anabœna*, similar to that which I have observed at Horn Pond and elsewhere.

3. *Is the matter injurious to health?*

The observations as to the effect on the human organism of water containing these algæ are not, of course, very definite or complete. In some places, however, where the only source of supply is thus affected, opportunity for observation is afforded. I have not been able to obtain any evidence of the unwholesomeness of the water from a supply which is, in other respects, of good quality. When the algæ are alive and fresh, horses and cattle drink the water readily, in preference to spring water; when decay has taken place, the water sometimes becomes so offensive that they refuse to drink it. In this condition it is manifestly unsuited to domestic use.

4. *Can anything be done to prevent the trouble?*

As far as our present knowledge extends,—nothing. The extent to which filtration of the water may mitigate the evil has been a matter of some experiments, and this point will be discussed at some length in the next Annual Report of the State Board of Health; I will therefore not forestall what I shall have to say in that place.

In conclusion, I wish to be distinctly understood as not asserting that all bad tastes and odors to which water supplies are subject are due to the presence of these or other algæ. They are the real cause of a real trouble. The occurrence of a *fishy, musty,* *cucumber*, *green corn*, or other peculiar odor or taste, may be due to the presence or decomposition of certain algæ, but it may be produced by the decay of more highly organized plants, or by causes of which we are ignorant. For instance, the cucumber taste which affected the Chestnut Hill Reservoir of the Boston Water Works in 1855, was traceable to no such cause, nor indeed to any assignable cause, although careful examinations were made from a chemical, from a botanical and from a zoological standpoint. Other cases also have come under my observation where no algæ, fresh or decomposed, could be found in sufficient quantity to account for the unpleasant taste which was very noticeable.

I should say that having begun the study of this matter some years since, I have been under obligations to many persons, to all of whom I am duly grateful, and of whom I should perhaps mention by name: Dr. W. G. Farlow, Assistant Professor of Botany in Harvard University, Geo. W. Carpenter, Esq., Superintendent of the Albany Water Works, and Thc. W. Davis, Esq., Superintendent of the Poughkeepsie (N. Y.) Water Works.

## PUMPING MACHINERY.

The Superintendent's Report represents the pumping machinery to be in excellent condition. We are reminded, however, that all machinery is liable to accident; and that the supply of water for city consumption is now delivered to the reservoir by one engine only. In case of an accident to the engine so serious as to require several weeks for repairs, the supply of water to the city would depend upon the quantity contained in the reservoir at the time of such accident, and the ability of the small Worthington engine to compensate the daily draught made upon it. This engine was not built for the service that would be required of it under such circumstances. The quantity of water it will deliver to the reservoir, when running night and day without interruption, is less than the average daily consumption ; and although it has been serviceable, and did excellent work in the early history of the water supply, it is no longer adapted to the duty required.

As the consumption of water will increase each year as new takers are added, and the economy in its use now practised in business establishments is relaxed, the exigency that will arise, if from any cause the engine now depended upon to supply the reservoir with water should be temporarily disabled, requires that the pumping works should, to some extent, be duplicated. At no time in the future is it likely that the prices for heavy machinery will be lower, neither is it probable that the means for purchasing a new engine can hereafter be more easily provided.

The time required to build and set up a new engine and boilers of the capacity desired will consume the larger part of a year. We therefore invite the early attention of the City Council to the necessity that exists for adding to the pumping works, and respectfully ask that a sufficient appropriation be made to so increase their capacity that the exigency suggested may be fully provided for.

## RECEIPTS AND EXPENDITURES.

The income of the Department for the past year has been $64,002.50. This amount shows an increase in the receipts, over those of the previous year, of $4,073.75.

The expenditures for the year were, for interest on the Water Debt $58,790.00, and for maintenance and office expenses, as given in detail in Clerk's Report, $9,052.38; total expenditure for interest and maintenance, $67,842.38.

The Construction Account was increased during the year by the sum of $5,509.67, which amount was mainly expended in laying additional distribution and service pipes.

From this statement it will be seen that the deficiency of income to meet payments for interest on water debt, and the expenses for maintenance, was $3,839.88, which sum is smaller than the receipts during the year from those whose names now first appear on the Registrar's books as water-takers. A like increase for the year 1878, which may be reasonably expected, will ensure an income quite sufficient to meet interest payments and the expense of maintenance for the coming year. No appropriation by the City Council, therefore, will be required to provide for the ordinary expenses of the department.

## COST OF THE WORKS.

The Water Works were mainly constructed in the years 1870–71. From the latter date to the present time each year has witnessed some extension of the works. The distribution pipes now laid extend through nearly fifty miles of our public streets. Nearly thirty-seven hundred dwellings, factories and business places, have been connected with the water distribution, and thirty miles of supply pipe have been put in for that purpose. Already more than four thousand families receive their daily supply of water through the water works of the city; while the number of takers for other purposes than for domestic use is nearly two thousand. Three hundred and sixty-six hydrants furnish an inexhaustible supply of water to the Fire Department for the extinguishment of fires.

At the date of this Report the gross cost of the works is $963,947.26 From this amount there should be deducted $29,630.66 received from water-takers for extra pipe, labor, &c., the cost of which is included in the gross sum given. With this deduction made, the net cost of the works will be found to be $934,316.60. In this amount is included all payments of interest that accrued during the time of construction of the works and the dates of final settlements with contractors. If we now add to the amount given as the net cost of the works the sum provided by the City Treasurer from other means than the Water Department has supplied, made necessary by the several annual deficiences of income to meet payments for interest and the expense of maintenance, which sum appears to be $65,996.36, the total net cost of the works will be increased to $1,000,312.86.

As the Water Debt is but $921,500.00, the difference between this amount and that given as the total net cost of the works, namely: $78,812.96, shows the amount that has been raised by taxation for the extension and maintenance of the works, and for payments of interest, since the works were built and the Water Department was organized. It will be readily seen that if this sum had been raised in any one year the rate of assessment on the city valuation would have been increased scarcely one-third of one per cent. Distributed as it has been over several years, the increase in the rate of taxation has been almost inappreciable. We invite attention to this statement for the reason that many citizens have erroneously believed that a high rate of taxation had become necessary, and must be continued in the future, in order to provide means for interest payments on account of the construction of the works, and for the maintenance of the department.

## FINANCIAL STANDING.

Having presented with some degree of particularity the cost of the works temporarily placed under our care, we offer for the consideration of the City Council some remarks on the financial standing of the department.

We have already stated the Water Debt to be $921,500. At the rates of interest the several loans now bear the total annual interest payments are $58,790. Fortunately, however, that portion of the water loan negotiated in 1873, amounting to $350,000, and bearing seven per cent. interest, will mature on the first of July next. In the present condition of the money market this amount could easily be placed, and a small premium secured, at a rate of interest not exceeding five per cent. Assuming that a loan can be effected at as favorable rates as we have named, the annual interest on the water debt, after the present year, will be reduced at least $7,000. This saving will be twice as large as the department deficiency for the past year. As the ordinary annual increase of receipts from water-rates will carry the income of the department for the coming year to an amount fully sufficient for the interest payments, and for the expenses of maintenance, the water works may now be regarded as not only self-sustaining, but as promising for the future such surplus income beyond ordinary wants that a sinking fund may be established for the extinguishment of the water debt. We need not remind the City Council that the Water Act, passed in 1871, requires that "The net surplus income and receipts shall be set apart as a sinking fund and applied solely to the payment of the principal of the Water Debt."

When we remember that for the last four years the leading industry of our community has been greatly depressed, the effect of which has been to retard the growth of the city and to repress the energy and enterprise of its citizens—compelling the business man and the laboring man alike to a prudent husbandry of means—the success that has attended the introduction of water into the city seems remarkable, and vindicates the judgment of those who, at the outset of the undertaking, claimed that not too soon was the work begun and a great want of the community supplied.

EDWIN WALDEN,
JACOB M. LEWIS,
JAMES PURINTON,
THOMAS B. NEWHALL,
DAVID H. SWEETSER.

Public Water Board.

# Report of the Clerk.

*Hon. Edwin Walden, President of the Public Water Board:*

I have the honor to submit, herewith, the Annual Report of the Clerk of the Board for the year ending December 31st, 1877.

The number of services on the first of January, 1877, was 3,423. There have been put in this year 249 services, and 5 have been discontinued (buildings removed), making the total number of services on the first of January, 1878—3,667.

Forty-six services have been shut off for non-payment, seventeen of which have been let on again by payment of the amount due and the sum of two dollars in each case, three have been let on without paying the two dollars, the property having changed owners, leaving twenty-six still remaining off. Twelve that were shut off previous to this year have been let on by payment of the amount due and the usual fine. One hundred and forty-eight services have been shut off by request, on account of vacant premises, and sixty-five have been let on again, leaving eighty-three still remaining off. There is now due on account of water the sum of $2,513.13, on amount of extra pipe, labor, &c., $204.98. All places supplied with city water have been visited during the year, and all leaky fixtures have been repaired.

The ratio of increase in the number of services for the last three years has been as follows: In 1875—5.23 per cent.; in 1876—6.54 per cent.; in 1877—7.6 per cent.

## RECEIPTS FOR THE YEAR 1877.

| | | |
|---|---|---|
| For use of water for all purposes . . . . . . . . . | $63,804 75 | |
| For fines—water shut off and let on again . . . | 58 00 | |
| For rents . . . . . . . . . | 125 00 | |
| For manure . . . . . . . . . . . . . . . . | 14 75 | |
| | | $64,002 |
| Extra pipe, labor, &c. . . . . . . . | | 1,734 |
| Total receipts . . . . . . . | | $65,737 |

All of which has been paid into the city treasury.

## COMPARATIVE STATEMENT OF REVENUE FOR 1877.

| | | |
|---|---|---|
| Amount collected in 1877 . . . . . | $64 002 50 | |
| Due and uncollected . . . . . . . . . . | 2,513 13 | |
| | | $66,515 63 |
| Deduct amount due at beginning of year . . . . . | | 2,723 17 |
| Revenue for 1877 . . . . . . . . . . . . . . . . | | $63,792 46 |
| Revenue for 1876, as per last Report . . . . . . . | | 59,718 71 |
| Increase in revenue for 1877 . . . . . . . . . . . . | | $4,073 75 |

## STATEMENT OF INTEREST, MAINTENANCE AND REVENUE, TO JAN. 1, 1877.

| | | |
|---|---|---|
| Interest for 1877 | $58,790 00 | |
| Maintenance for 1877 | 9,052 38 | |
| | | $67,842 38 |
| Revenue for 1877 | | 64,002 50 |
| Deficiency of revenue to meet interest and maintenance | | 3,839 88 |
| Deficiency previously accrued | | 62,156 38 |
| Total deficiency of revenue to meet the cost of maintenance and interest to date | | $65,996 26 |

## EXPENDITURES FOR THE YEAR 1877.

### MAINTENANCE.

| | | |
|---|---|---|
| Salaries and office expenses | $2,540 86 | |
| Repairs of services and miscellaneous | 897 71 | |
| Repairs of mains, hydrants and gates | 453 53 | |
| Repairs on reservoir and road | 118 27 | |
| Labor at Breed's Pond | 20 02 | |
| Labor at Birch Pond | 38 40 | |
| Repairs in Engine House | 51 91 | |
| Repairs on engine and boilers | 219 41 | |
| Pumping, wages, coal oil, waste, &c. | 4,017 49 | |
| Stable, wages, hay, grain, repairs, &c. | 494 78 | |
| | | $9,0 |

### CONSTRUCTION.

| | | |
|---|---|---|
| Services and court mains | $4,813 20 | |
| Distributing mains, hydrants and gates | 644 72 | |
| Meters | 26 75 | |
| Land damages at Birch Pond | 25 00 | |
| | | $5,5 |

## TOTAL EXPENDITURES TO JAN. 1, 1878.

| | | |
|---|---|---|
| Breed's Pond, land and buildings | $30,305 91 | |
| Birch Pond and land | 42,809 90 | |
| Pipe, conduit and right of way | 43,785 98 | |
| Reservoir and land | 131,482 30 | |
| Force main and land | 24,614 00 | |
| Engine House and land | 55,112 79 | |
| Engines and boilers | 63,444 72 | |
| Distributing mains, hydrants and gates | 455,610 78 | |
| Services and court mains | 102,348 67 | |
| Meters | 4,270 57 | |
| Workshop and stable | 1,696 65 | |
| Engineering | 8,464 99 | |
| | | $963,947 26 |

### CREDIT.

| | |
|---|---|
| By amount received for extra pipe, &c. | 29,630 66 |
| Total net expenditures to date | $934,316 60 |

Respectfully submitted.

DANIEL WALDEN, Clerk.

*Lynn, Jan.* 10, 1878.

## EXPEN

Salaries and offic
Repairs of servic
Repairs of mains
Repairs on reserv
Labor at Breed's
Labor at Birch P
Repairs in Engine
Repairs on engine
Pumping; wages, c
Stable, wages, hay,

Services and court m
Distributing mains, b
Meters. . . . . . .
Land damages at Sto

## STATEMENT

SHOWING THE NUMBER OF FAMILIES, STORES, FACTORIES, &C., SUPPLIED WITH CITY WATER, WITH THE AMOUNT OF REVENUE RECEIVED DURING THE YEAR 187[illegible].

| | |
|---|---|
| [illegible] Families | $[illegible] |
| [illegible] Boarding Houses | [illegible] |
| [illegible] Hotels | [illegible] |
| [illegible] Stores | [illegible] |
| [illegible] Offices | [illegible] |
| [illegible] Restaurants and Saloons | [illegible] |
| [illegible] Stables | [illegible] |
| [illegible] Stationary Steam Engines | [illegible] |
| [illegible] Elevators and Steam Engines | [illegible] |
| [illegible] Railroads | [illegible] |
| [illegible] Steam Fire Engines and Hose Houses | [illegible] |
| [illegible] School-Houses | [illegible] |
| [illegible] Churches | [illegible] |
| [illegible] Public Halls | [illegible] |
| [illegible] Printing Offices | [illegible] |
| [illegible] Greenhouses | [illegible] |
| [illegible] Bakeries | [illegible] |
| [illegible] Barber Shops | [illegible] |
| [illegible] Planing Mills | [illegible] |
| [illegible] Machine and Blacksmith Shops | [illegible] |
| [illegible] Markets | [illegible] |
| [illegible] Banks | [illegible] |
| [illegible] Photographers | [illegible] |
| [illegible] Druggists | [illegible] |
| [illegible] Hand Hose | [illegible] |
| [illegible] Hotels | [illegible] |
| [illegible] City Hall | [illegible] |
| [illegible] Post Office | [illegible] |
| [illegible] | [illegible] |
| [illegible] | [illegible] |
| [illegible] | [illegible] |
| [illegible] and [illegible] | [illegible] |
| [illegible] | [illegible] |
| [illegible] and other persons | [illegible] |
| [illegible] | [illegible] |
| [illegible] | $[illegible] |

## STATEMENT

IE YEARLY REVENUE OF THE WATER DE-
SINCE THE FIRST INTRODUCTION OF WATER
ITY, in 1871.

| | |
|---|---|
| t, 1871, to January 1st, 1872 . . . . . . . . . . | $8,989 00 |
| t, 1872, to January 1st, 1873 . . . . . . . . . . | 27,568 16 |
| t, 1873, to January 1st, 1874 . . . . . . . . . . | 47,992 61 |
| t, 1874, to January 1st, 1875 . . . . . . . . . . | 53,545 61 |
| , 1875, to January 1st, 1876 . . . . . . . . . . | 52,553 26 |
| , 1876, to January 1st, 1877 . . . . . . . . . . | 60,867 12 |
| 1877, to January 1st, 1878 . . . . . . . . . . | 64,002 50 |
| | $315,518 26 |

# STATEMENT

SHOWING THE NUMBER AND KINDS OF FIXTURES CONTAINED WITHIN THE PREMISES OF WATER-TAKERS TO DECEMBER 31st, 1877, AS COMPARED WITH THE PREVIOUS YEAR.

| Kind of Fixture. | 1876. | 1877. | Increase. | Decrease. |
|---|---|---|---|---|
| Faucets | 6,923 | 6,870 | | 53 |
| Bath Tubs | 371 | 393 | 22 | |
| Water Closets—pan | 880 | 976 | 96 | |
| Water closets—hopper | 58 | 105 | 47 | |
| Water Closets—self-acting hopper | 75 | 7 | | 68 |
| Hand Hose | 956 | 972 | 84 | |
| Totals | 9,263 | 9,323 | | |

## TABLE

### CLASS OF PREMISES TO WHICH METERS ARE ATTACHED.

| ame. | Class. | Size. | | | | |
|---|---|---|---|---|---|---|
| | | 5/8 | 3/4 | 1 | 1½ | 2 |
| any | | | | 1 | | 1 |
| d Company | | | 1 | | | 1 |
| | | | | 1 | | |
| | Engine. | | | 1 | | |
| | do | | 1 | | | |
| | do | | | 1 | | |
| | do | | | 1 | | |
| | do | | | 1 | | |
| | do | | | 1 | | |
| | do | | | 1 | | |
| | do | | | 1 | | |
| | do | | | 1 | | |
| | do | | | 1 | | |
| | do | 1 | | | | |
| | do | | | 1 | | |
| | do | | | | 1 | |
| | do | | 1 | | | |
| | do | 1 | | | | |
| | do | | | 1 | | |
| | do | | | 1 | | |
| | do | 1 | | | | |
| | do | 1 | | | | |
| | do | | 1 | | | |
| | do | | | 1 | | |
| | do | | | 1 | | |
| | do | | | 1 | | |
| | do | 1 | | | | |
| | do | | | 1 | | |
| | do | | 1 | | | |
| | Factory. | | | 1 | | |
| | do | | | 1 | | |
| | do | | 1 | | | |
| | do | | | 1 | | |
| | do | | | 1 | | |
| | do | | 1 | | | |
| | do | | | 1 | | |
| | do | 1 | | | | |
| | do | 1 | | | | |
| | do | 1 | | | | |
| | do | | | 1 | | |
| | | 8 | 7 | 24 | 1 | 2 |

[TABLE EXHIBITING THE CLASSES OF PREMISES TO WHICH METE

ARE ATTACHED—*Continued.*]

| Name. | Class. | Size. | | | | |
|---|---|---|---|---|---|---|
| | | ⅝ | ¾ | 1 | 1½ | |
| *Brought forward* | | 8 | 7 | 24 | 1 | |
| L. S. Johnson | Factory. | | | 1 | | |
| B. Dupar & Co. | do | 1 | | | | |
| J. Davis & Co. | do | | 1 | | | |
| J. Doherty & Co. | do | | 1 | | | |
| W. Claflin | do | 1 | | | | |
| Mower Bros. | do | 1 | | | | |
| B. F. Doak & Co. | do | | 1 | | | |
| F. W. Breed | do | | 1 | | | |
| B. F. Spinney | do | | 1 | | | |
| P. P. Sherry | do | 1 | | | | |
| Chas. Buffum | do | 1 | | | | |
| F. B. Mower | do | 1 | | | | |
| P. J. Hanley | do | 1 | | | | |
| Geo. W. Clark | do | 1 | | | | |
| Spinney & Caldwell | do | 1 | | | | |
| Pierce & Ellis | do | 1 | | | | |
| Kimball Bros. | do | 1 | | | | |
| J. J. Grover | do | 1 | | | | |
| Bartlett & Doak | do | 1 | | | | |
| J. N. Smith | do | | | 1 | | |
| John Dougherty | do | 1 | | | | |
| C. B. Lancaster | do | 1 | | | | |
| C. H. Aborn & Co. | do | 1 | | | | |
| Breed, Dole & Co. | do | | 1 | | | |
| T. P. Richardson & Co. | do | | 1 | | | |
| Brown & Oliver | do | | 1 | | | |
| Stowell & Rhodes | do | 1 | | | | |
| Geo. W. Downing | do | 1 | | | | |
| John Mahon & Son | do | | | 1 | | |
| Breed & Wells | do | 1 | | | | |
| Breed & Doak | do | | | 1 | | |
| C. A. Coffin | do | | | 1 | | |
| C. S. Sweetser | do | | 1 | | | |
| J. T. Moulton | do | | | 1 | | |
| Morgan & Dore | do | | | 1 | | |
| W. H. Holt | do | | 1 | | | |
| E. W. & C. F. Mower | do | | 1 | | | |
| E. H. Newhall<br>Geo. D. Whittle | do | 1 | | | | |
| J. E. Farrar & Co. | do | 1 | | | | |
| F. P. Burnham & Co. | do | 1 | | | | |
| Lewis & Collyer | do | 1 | | | | |
| James Phelan | do | | | 1 | | |
| C. H. Bacheller & Co.<br>T. C. Murphy | do | 1 | | | | |
| *Carried forward,* | | 32 | 18 | 32 | 1 | 2 |

EXHIBITING THE CLASSES OF PREMISES TO WHICH METERS ARE ATTACHED—*Concluded.*]

| Name. | Class. | Size. | | | | |
|---|---|---|---|---|---|---|
| | | ⅝ | ¾ | 1 | 1¼ | 2 |
| *ht forward,* | | 32 | 18 | 32 | 1 | 2 |
| orter | Factory. | 1 | | | | |
| & Lindsey | | | | | | |
| indram | do | | | 1 | | |
| ubier | do | | | 1 | | |
| nair | do | | | 1 | | |
| Bros. | do | | | 1 | | |
| Trask & Co. | do | | 1 | | | |
| pinney & Co. | do | | | 1 | | |
| llows' Hall | Building. | | | 1 | | |
| y of Music | do | | | 1 | | |
| lethen | do | | 1 | | | |
| & Pickford | do | | 1 | | | |
| d House | Hotel. | 1 | | | | |
| ower | Stable. | 1 | | | | |
| allace | do | 1 | | | | |
| elman | do | 1 | | | | |
| reed | do | 1 | | | | |
| lake | Laundry. | 1 | | | | |
| erry | Dwelling. | 1 | | | | |
| , 103 | | 40 | 21 | 39 | 1 | 2 |

# Report of the Superintendent.

*Hon. Edwin Walden, President of the Public Water Board:*

I have the honor to present, herewith, the Annual Report of the Superintendent for the year ending December 31st, 1877.

## PONDS.

The ponds are in good condition, and have required but little expense this year. The water now stands higher than ever before at the same season of the year, Breed's Pond standing, on January 1st, at 14 ft. 3½ in., and Birch Pond at 12 ft. 10½ in.

Early in the summer the water in Birch Pond was affected with a microscopic vegetable growth which gave it an unpleasant odor and taste, and during the warm weather no water was used from that pond; all the water for the use of the city was taken from Breed's Pond, and proved unexceptionably good. As soon as the cool weather of the fall set in the water in Birch Pond began to improve, and is now quite equal to that of Breed's Pond in quality; and it has been used exclusively for the supply of the city since November.

The heavy rains during the spring months, and the melting of the large amount of snow accumulated during the winter, brought forward so large a quantity of water at once that the ponds, which had accumulated a large surplus during the two preceding years, were unable to contain it, and a large quantity ran to waste. The large rainfall of the year, and the favorable conditions for yielding a large percentage, have given an amount for use equal to 53.12 per cent. of the rainfall, or 24.25 inches over the entire drainage area exclusive of water surfaces.

Many people, judging from the large quantity of water which ran to waste, appear to think that the actual supply of our water sources is much larger than has been represented, and that the city is in no danger of a short supply for many years to come. If we were sure of 45 inches of rain every year, and could rely upon 24¼ inches being available for use, such would be the fact ; but the rainfall and also the conditions for collecting vary from year to year, which facts render the quantity which can be made available for use, for any given year, very uncertain. The following facts may not be out of place in this connection :

It is generally agreed among engineers that a city depending upon the yearly rainfall for its supply of water is not safe from a water famine unless the supply is ample in a year of minimum rainfall.

Mr. Kirkwood, who stood at the head of his profession as a Hydraulic Engineer, and who made the report upon an additional supply of water for this city in 1876, estimates the available quantity that can be relied upon from Breed's and Birch Ponds at 1,135,570 gallons per day, a point at which we have very nearly arrived at the present time. The records at Lake Cochituate show the average proportion of the rainfall available for use, for nine years from 1863 to 1871, to be 37 per cent., varying from 50 per cent., the largest yield of any one year, to 26 per cent., the smallest yield. The average rainfall in this vicinity is reckoned at 42 inches; records have not been kept in this city a sufficient length of time to give an approximate average. The lowest rainfall in any year since a record has been kept was 35 inches, in 1874. The records at Mystic Lake give the rainfall for 1870 at 24.65 inches, and for 1871 at 24.36 inches, only a fraction of an inch in excess of the amount yielded by the area draining into Breed's and Birch Ponds during the past year.

With a rainfall of 35 inches, if 45 per cent. could be utilized, it would yield 1,011,129 gallons per day, and two years of such a rainfall would exhaust all the surplus water now held in store. The same rainfall by the Cochituate ratios of 39 per cent. would yield only 876,312 gallons per day, leaving us the second year with scarcely any resources.

With an average of 42 inches of rain, if 50 per cent. could be relied upon for use, the yield would equal a daily consumption of 1,379,416 gallons. In 1875 the daily consumption in this city amounted to 1,291,471 gallons. By a careful inspection of all the fixtures in the city, to prevent waste, the consumption has been reduced, in 1877, to 1,101,811 gallons per day, or to 56 gallons per day to each consumer, which is below the general average of cities in this vicinity; but taking this moderate consumption as a basis, and allowing for an annual increase of six per cent. for the next three years, the consumption will reach, in 1880, 1,312,273 gallons per day, virtually using the whole available supply even upon a basis of an average rainfall with favorable conditions for collection.

Considering the time that must elapse before any new supply could be made available for use, it would appear to be the part of prudence to make provision at an early day for a permanent and ample supply.

## RESERVOIR.

The Reservoir is in good condition, except the outside slope of the embankment, which remains the same as at last report. The road has been repaired and is now in good order.

## PUMPING STATION.

The Engine House has required some slight repairs upon the roof. It is hoped that in the spring the grounds may be fenced and otherwise improved.

The engine and boilers are in good condition, and the engine continues to work with the same economy as in previous years. After five years' use it now runs as smoothly as at any previous time. The small duplex pump has not been started up for the year.

The furnaces and boiler settings have been thoroughly repaired, and may last one or two years more. In May a small crack was discovered in the wall of the low-pressure cylinder, near the bottom, causing a leak between the jacket and the cylinder. A hole was cut in the jacket, and the space between the jacket and the cylinder filled with type-metal, which so far stopped the leak that no trouble has been experienced since ; and the duty, which had fallen off in May some ten millions, was brought up to the usual standard, and has continued so to the present time.

I desire to call your attention to the necessity of soon providing another engine for pumping service. All machinery is liable to break down. Heretofore the small duplex pump has answered as a reserve by running it constantly when called into use ; but we have about outgrown that, so that if a break of any magnitude should occur the supply of the city might be endangered before the necessary repairs could be made. It will take nearly a year for a new engine to be built and set up ready for use. If there should be an improvement in business the coming year the present consumption of water is likely to be much increased, thereby rendering the situation still more critical. I would therefore recommend that the necessary steps be taken, at an early day, to procure a new set of pumping machinery.

## PIPES.

There has been laid during the year 1877, in vario streets and courts, 859 feet 6 inches of 6-in. pip 1,182 feet 4 inches of 4-in. pipe; 1,284 feet 5 inch of 2-in. pipe; 107 feet 10 inches of $1\frac{1}{2}$-in. pipe; feet of 1-in. pipe. Four hydrants and eight gates ha been set in connection with new pipe. Two 4-in. pi and two 2-in. pipes have been connected with factor for fire purposes. Two 2-in. stand-pipes for water-ca and 249 services have been put in, of aggregate len of 10,936 feet, making the total length of service-p laid in the city 29 miles 3,324 feet.

Eighty-four leaks in pipes have been repaired, and the pipes are believed to be in good condition. The hydrants have received careful attention, forty-th have been repaired, and all are now in good work order. Eight gates have been repaired, twenty-th new gate-boxes and five service boxes have been set replace those that were rotten.

Annexed please find the usual tables and diagra showing the rainfall, height of water in ponds for e month, and consumption of water for each day.

Respectfully submitted.

DANIEL WALDEN, SUPERINTENDEN

## PIPES.

There has been laid during the year 1877, in various streets and courts, 859 feet 6 inches of 6-in. pipe; 1,182 feet 4 inches of 4-in. pipe; 1,284 feet 5 inches of 2-in. pipe; 107 feet 10 inches of 1½-in. pipe; 37 feet of 1-in. pipe. Four hydrants and eight gates have been set in connection with new pipe. Two 4-in. pipes and two 2-in. pipes have been connected with factories for fire purposes. Two 2-in. stand-pipes for water-carts and 249 services have been put in, of aggregate length of 10,936 feet, making the total length of service-pipe laid in the city 29 miles 3,324 feet.

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Annexed please find the usual tables and diagrams, showing the rainfall, height of water in ponds for each month, and consumption of water for each day.

Respectfully submitted.

DANIEL WALDEN, Superintendent.

# TABLE I.

## ENGINE RECORD FOR THE YEAR ENDING DECEMBER 31st, 1877.

| | | | | | | | | Coal Consumed. | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number of Pumping Days. | Average pumping time per day. | | Total pumping time per month. | | Total number of Revolutions per month. | Average Revolutions per minute. | Raising steam. | Pumping. | Banking. | Total. | Ashes and cinders. | Ashes and cinders. | Total number of gallons pumped per month, allowing 4 per cent. for loss of action in the pump. | Average number of gallons pumped into the Reservoir per lb. coal. | Average number of gallons raised 100 feet high per pound of coal. | Average head against the pump. | Average duty in pounds of water raised one foot high per 100 lbs. of coal, calculated on the total coal consumed, no deduction for ashes and cinders. | Average duty, calculated on the total coal consumed, ashes and cinders deducted. | Average duty, calculated on the coal consumed while pumping, no deduction for ashes and cinders. | Average duty, calculated on the coal consumed while pumping, ashes and cinders being deducted. |
| Month. | Dys | H. | M. | H. | M. | Revo'ns. | Rev. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | p.ct. | Gallons. | Gal's | Galls. | Feet. | Lbs. | Lbs. | Lbs. | Lbs. |
| January .. | 9 | 15 | 30 | 139 | 30 | 155,851 | 18.02 | 8,800 | 37,350 | 1,500 | 47,650 | 5,100 | 10.84 | 29,074,004 | 617.94 | 1,013.43 | 164.01 | 87,999,142 | 96,697,488 | 110,853,002 | 124,327,657 |
| February . | 9 | 15 | 33 | 139 | 55 | 156,081 | 18.59 | 8,200 | 37,700 | 1,500 | 47,100 | 5,270 | 11.12 | 29,116,910 | 614.28 | 1,013.13 | 164.93 | 87,958,781 | 98,961,458 | 110,590,085 | 124,421,684 |
| March .... | 12 | 15 | 10 | 182 | 05 | 202,770 | 18.56 | 10,850 | 49,000 | 2,100 | 61,950 | 7,240 | 11.68 | 37,826,743 | 610.60 | 1,009.93 | 165.44 | 87,713,579 | 99,321,078 | 110,895,025 | 125,568,614 |
| April ..... | 10 | 15 | 19 | 153 | 10 | 171,057 | 18.61 | 8,600 | 42,650 | 1,800 | 53,050 | 6,000 | 11.31 | 31,910,083 | 601.52 | 998.28 | 165.96 | 86,674,613 | 97,727,698 | 107,809,866 | 121,558,933 |
| May ...... | 10 | 14 | 22 | 143 | 40 | 160,841 | 18.66 | 8,700 | 45,200 | 1,800 | 55,700 | 5,920 | 10.63 | 30,004,888 | 538.70 | 893.92 | 165.94 | 77,609,978 | 86,839,609 | 95,638,841 | 107,012,471 |
| June...... | 12 | 15 | 37 | 187 | 39 | 209,960 | 18.66 | 10,500 | 52,250 | 1,800 | 64,550 | 6,420 | 9.95 | 39,168,038 | 606.80 | 1,008.92 | 166.28 | 87,603,666 | 97,278,801 | 108,226,157 | 120,182,281 |
| July ...... | 11 | 15 | 20 | 168 | 40 | 188,422 | 18.62 | 8,900 | 46,900 | 2,100 | 57,900 | 7,500 | 12.90 | 35,150,124 | 607.10 | 1,006.69 | 165.82 | 87,405,493 | 100,412,262 | 107,905,715 | 121,513,240 |
| August ... | 13 | 15 | 16 | 198 | 25 | 221,710 | 18.62 | 10,400 | 56,000 | 2,400 | 68,800 | 9,300 | 13.52 | 41,360,000 | 601.16 | 995.94 | 165.67 | 86,478,320 | 99,995,100 | 106,244,794 | 122,849,177 |
| September | 12 | 15 | 32 | 186 | 20 | 206,737 | 18.49 | 9,000 | 49,500 | 2,100 | 61,500 | 7,895 | 12.83 | 38,566,787 | 627.10 | 1,038.92 | 165.68 | 90,209,754 | 103,495,940 | 112,078,785 | 128,629,058 |
| October .. | 10 | 14 | 56 | 149 | 25 | 165,584 | 18.47 | 8,600 | 38,000 | 1,800 | 49,300 | 6,030 | 12.23 | 30,889,695 | 626.56 | 1,041.78 | 166.27 | 90,460,760 | 103,067,147 | 114,645,385 | 130,622,268 |
| November | 9 | 15 | 26 | 139 | 09 | 154,880 | 18.57 | 8,900 | 36,350 | 1,200 | 46,650 | 5,520 | 11.83 | 28,892,864 | 619.35 | 1,029.36 | 166.20 | 89,380,879 | 101,376,500 | 114,079,834 | 129,390,781 |
| December | 9 | 15 | 32 | 139 | 50 | 155,130 | 18.47 | 8,200 | 36,300 | 1,500 | 46,000 | 5,630 | 12.24 | 28,939,501 | 629.12 | 1,043.20 | 165.82 | 90,575,666 | 103,207,500 | 112,024,261 | 130,774,060 |
| Tot. & av's | 126 | 15 | 18 | 1927 | 30 | 2,149,023 | 18.58 | 109,950 | 528,300 | 21,600 | 659,850 | 77,825 | 11.79 | 400,900,237 | 607.56 | 1,006.54 | 165.67 | 87,398,946 | 98,074,392 | 109,161,829 | 123,758,174 |

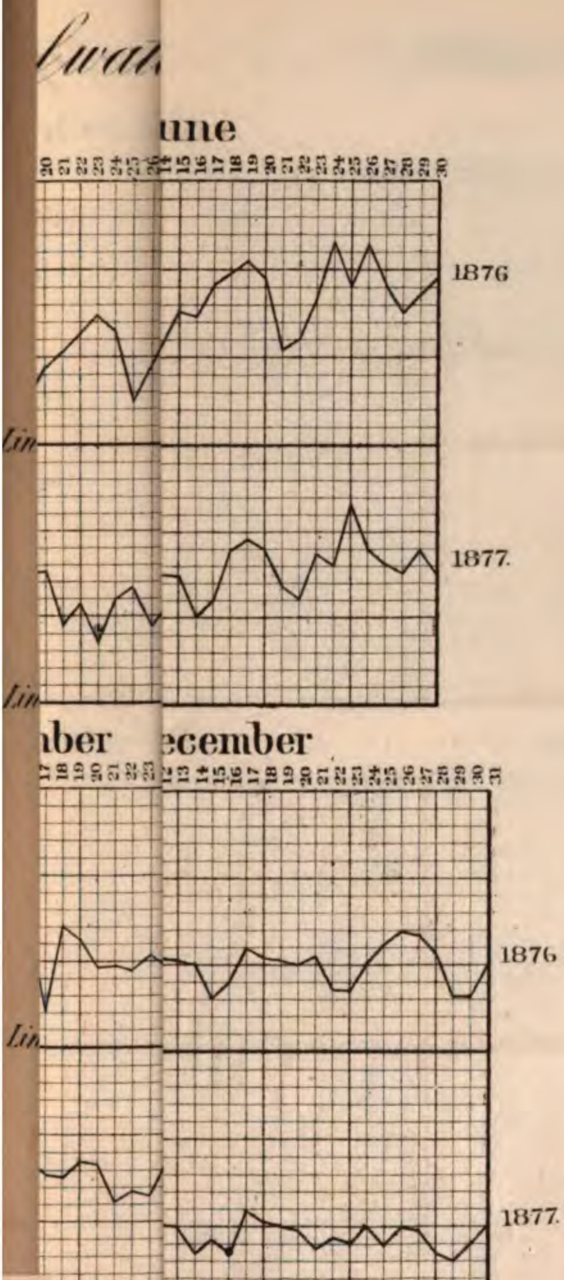
# COST OF PUMPING.

| | | |
|---|---|---|
| 659,850 lbs. of coal, average price $5.09 per net ton | | $1,678 06 |
| 47,500 lbs. of coal for heating, average price $5.76 per net ton | | 136 90 |
| 14 cords of wood, average price $4.37½ | | 61 25 |
| Lighting, $15.90; sundries, $40.67 | | 56 57 |
| Oil, waste, packing, &c. | | 75 30 |
| Repairs on Engine and Boilers | | 219 41 |
| Wages of Engineer and Fireman | | 1,860 00 |
| | | $4,087 49 |
| Cost of raising one million gallons into the reservoir | $10 16$\frac{38}{100}$ | |
| Cost of raising one million gallons one foot high | 0 06$\frac{13}{100}$ | |

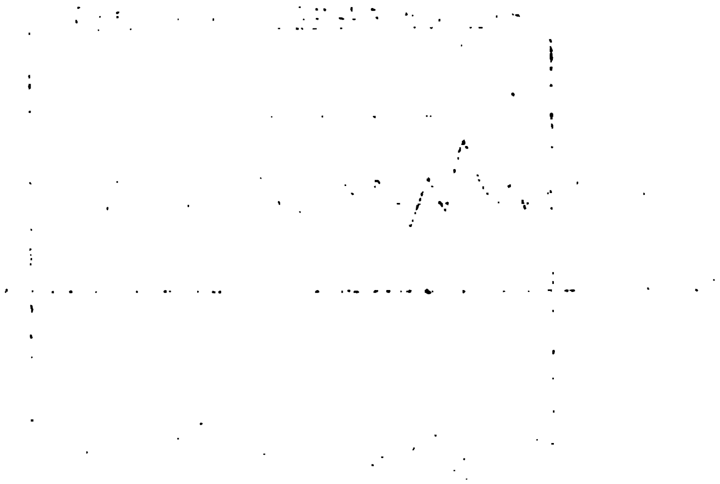
## TABLE II.

### SHOWING THE CONSUMPTION OF WATER FOR THE YE ENDING DECEMBER 31, 1877.

| Month. | Water drawn from Reservoir. Gallons. | Average consumption per day. Gallons. | Average daily increase. Gallons. | Average daily decrease. Gallons. | Average to each consumer. Galls. |
|---|---|---|---|---|---|
| January . . . | 32,362,530 | 1,043,952 | | | 53 |
| February . . . | 29,270,957 | 1,045,391 | 1,439 | | 53 |
| March . . . . | 32,449,547 | 1,046,759 | 1,368 | | 53.1 |
| April . . . . . | 31,749,542 | 1,058,318 | 11,559 | | 53.7 |
| May . . . . . | 31,735,658 | 1,023,731 | | 34,587 | 52 |
| June . . . . . | 36,070,151 | 1,202,338 | 178,607 | | 61 |
| July . . . . . | 39,825,121 | 1,284,681 | 82,343 | | 65.2 |
| August . . . . | 38,886,250 | 1,254,395 | | 30,286 | 63.7 |
| September . . | 38,083,364 | 1,269,445 | 15,050 | | 64.4 |
| October . . . | 32,895,708 | 1,061,152 | | 208,293 | 53.9 |
| November . . | 28,892,864 | 963,095 | | 98,057 | 49 |
| December . . | 29,939,501 | 949,920 | | 13,175 | 48.2 |
| Tot's & averag's | 402,161,193 | 1,101,811 | | | 55.9 |



Bufford's Lith. Boston



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TILDEN FOUNDATIONS.

# TABLE III.

## SHOWING THE DEPTH OF WATER IN THE PONDS FOR EACH WEEK DURING THE YFAR 1877.

| Date. | | Breed's Pond. | | Birch Pond. | | Date. | | Breed's Pond. | | Birch Pond. | | Date. | | Breed's Pond. | | Birch Pond. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ft | In. | Ft | In. | | | Ft | In. | Ft | In. | | | Ft | In. | Ft | In. |
| Jan. | 1 | 13 | 4½ | 10 | 9 | May | 12 | 18 | 1 | 14 | 6½ | Sept. | 22 | 10 | 3½ | 12 | 8 |
| | 6 | 13 | 4½ | 10 | 7 | | 19 | 18 | 1 | 14 | 5 | | 29 | 9 | 4½ | 12 | 6½ |
| | 13 | 14 | 0 | 10 | 10½ | | 26 | 18 | 2½ | 14 | 5 | Oct. | 6 | 9 | 0½ | 12 | 10½ |
| | 20 | 14 | 2½ | 10 | 11 | June | 2 | 18 | 0½ | 14 | 1½ | | 13 | 8 | 10 | 12 | 11 |
| | 27 | 13 | 11½ | 11 | 0 | | 9 | 18 | 2½ | 14 | 1½ | | 20 | 8 | 5 | 12 | 11½ |
| Feb. | 3 | 14 | 0¼ | 11 | 0½ | | 16 | 17 | 7½ | 14 | 1 | | 27 | 7 | 8 | 13 | 0 |
| | 10 | 14 | 4 | 11 | 1¾ | | 23 | 17 | 1 | 13 | 11 | Nov. | 3 | 7 | 8½ | 13 | 2 |
| | 17 | 14 | 5 | 11 | 3¾ | | 30 | 16 | 6 | 13 | 9 | | 10 | 8 | 2½ | 13 | 6 |
| | 24 | 14 | 2½ | 11 | 5½ | July | 7 | 16 | 0 | 13 | 8½ | | 17 | 8 | 9 | 13 | 5½ |
| March | 3 | 14 | 7 | 12 | 0 | | 14 | 15 | 9 | 13 | 8 | | 24 | 9 | 2 | 13 | 2 |
| | 10 | 16 | 1 | 12 | 9 | | 21 | 15 | 2 | 13 | 6½ | Dec. | 1 | 12 | 0 | 13 | 6½ |
| | 17 | 17 | 2 | 13 | 2 | | 28 | 14 | 7 | 13 | 4½ | | 8 | 13 | 1½ | 13 | 5½ |
| | 24 | 17 | 10 | 13 | 7½ | August | 4 | 14 | 0 | 13 | 3½ | | 15 | 13 | 8 | 13 | 3½ |
| | 31 | 17 | 8½ | 14 | 1 | | 11 | 13 | 6 | 13 | 2½ | | 22 | 14 | 0 | 13 | 1½ |
| April | 7 | 17 | 8½ | 14 | 0½ | | 18 | 13 | 1½ | 13 | 2 | | 29 | 14 | 2½ | 12 | 10½ |
| | 14 | 17 | 7 | 14 | 1 | | 25 | 12 | 7½ | 13 | 1½ | | | | 1 | | |
| | 21 | 17 | 11 | 14 | 5½ | Sept. | 1 | 12 | 1 | 13 | 1 | | | | | | |
| | 28 | 18 | 0½ | 14 | 4½ | | 8 | 11 | 6½ | 12 | 11 | | | | | | |
| May | 5 | 18 | 2 | 14 | 6½ | | 15 | 10 | 11 | 12 | 9½ | | | | | | |

# TABLE IV.

## EXHIBITING THE RAINFALL AT THE PUMPING STATION FOR THE YEAR 1877.

| Day of the Month. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .62 | .09 | | .03 | .31 | | .88 | | .11 | | | |
| 2 | .02 | | .85 | .35 | | | | | .03 | | .82 | |
| 3 | | | | | | | | | | .03 | | |
| 4 | | | .15 | | | | | | | 5.42 | | .39 |
| 5 | | | | .86 | | .20 | .37 | | | | .22 | .26 |
| 6 | | | | .04 | | 1.00 | | | | | | |
| 7 | 1.05 | | | | | .65 | | | | | | |
| 8 | | | .05 | | | .02 | | | | | .87 | |
| 9 | | | .86 | | .20 | | .65 | .50 | | .97 | .29 | |
| 10 | | | | | .35 | | .41 | .71 | | | | .05 |
| 11 | | | | | | | | .01 | | .65 | | |
| 12 | .33 | | .64 } | | | | | .02 | | | | .02 |
| 13 | | | | | | | .12 | .08 | | | | .01 |
| 14 | | | 1.15 | | | .02 | | | | | | |
| 15 | 1.03 | | | | | | | .74 | | | | |
| 16 | | | .15 | | .01 | .09 | | | | .10 | .02 | |
| 17 | | | | .10 | | | | | .40 | | | |
| 18 | | | .05 | .19 | | | | .11 | | | .02 | |
| 19 | | | | 1.15 | | | .12 | | | .45 | | |
| 20 | .05 | | | .26 | | | .18 | | | .47 | | |
| 21 | | | | | | .20 | | | .09 | .29 | | |
| 22 | | | .85 | .02 | .15 | | | | | .22 | | |
| 23 | | | 1.05 | | | | | | | | | |
| 24 | | .75 } | | | .55 | | | | | | | |
| 25 | | | | | .37 | | | 1.46 | | .03 | 2.10 | |
| 26 | | | 2.19 | | | | | | | | 2.34 | |
| 27 | | | .21 | | | | | | | | | |
| 28 | .04 | | .08 | .65 } | | | .31 | .11 | .03 | | | |
| 29 | | | | | | | | .05 | | | .88 | |
| 30 | | | | .20 | | .21 | .13 | | | | | .02 |
| 31 | .08 | | | | | | | | | .57 | | |
| Tots. | 3.22 | .84 | 8.28 | 3.85 | 1.94 | .239 | 3.17 | 3.79 | .66 | 9.20 | 7.56 | .75 |

Total rainfall for the year, 45.65 inches.

# TABLE V.

## SHOWING THE AMOUNT AND SIZE OF PIPE LAID IN THE YEAR 1877.

| Names of Streets. | | | Size of Pipe in Inches. | | | | |
|---|---|---|---|---|---|---|---|
| Street. | From | To | 6 | 4 | 2 | 1½ | 1 |
| Hanover . . . | Washington | Johnson . | | 501.4 | | | |
| Oakwood Ave. | Chatham . | Wellington | 859.9 | | | | |
| Empire . . . . | Extension . | | | 209. | | | |
| Friend St Ct. . | Extension . | | | 298. | | | |
| Tremont Ct. . . | Tremont . | | | 174. | 141.6 | | |
| Goodwin's Ct. . | Ingalls . . | | | | 277. | 17.6 | 31. |
| Allen Ct. . . . | Fayette Ct. | Orange Ct. | | | 165. | 30.10 | |
| Orange Ct. . . | Fayette . . | Allen Ct. . | | | 197.4 | 41. | |
| Bloomfield Ct. . | Fayette . . | | | | 342.9 | | |
| Fayette . . . . | Extension . . | | | | 160.10 | 18.6 | |
| Totals . . . . . | | | 859.9 | 1,182.4 | 1,248.5 | 107.10 | 31. |

| | |
|---|---|
| Total extension of street mains in 1877 | 3,465 ft. 4 in. |
| Previously laid . . . . . . . . . . . | 48 miles, 5.109 ft. |
| Total amount of pipe laid to date . . . | 49 miles, 3,294 ft. |

## TABLE VI.

### SHOWING THE NUMBER AND LOCATION OF GATES SET IN THE YEAR 1877.

| Street. | Location. | Inches. |
|---|---|---|
| Hanover St. . | 15 ft. N. of S. line of Hanover Street.<br>On a line with the E. side of Johnson Street. | 4 |
| Hanover St. . | 16 ft. 9 in. N. of S. line of Hanover Street.<br>On a line with the W. side of Washington Street. | 4 |
| Oakwood Av. | 13 ft. S. of N. line of Oakwood Avenue.<br>On a line with the E. side of Chatham Street. | 6 |
| Tremont Ct. | 5 feet 10 in. E. of W. line of Tremont Court.<br>6 in. N. of N. line of Tremont Street. | 4 |
| Goodwin's Ct. | 10 feet W. of E. line of Goodwin's Court.<br>6 in. N. of N. line of Ingalls Street. | 2 |
| Orange Ct. . | 6 ft. 6 in. S. of N. line of Orange Court.<br>On a line with the E. side of Fayette Street. | 2 |
| Bloomfield Ct. | 22 ft. S. of N. line of Bloomfield Court.<br>On a line with the E. side of Fayette Street. | 2 |
| Fayette St. . | 12 feet W. of E. side of Fayette Street.<br>6 in. S. of N. line of Collins St. | 2 |

| | |
|---|---|
| Total number of gates set in 1877 . . . . . . . . . . . . . . | 8 |
| Number of gates previously set . . . . . . . . . . . . . . . . | 325 |
| Total number of gates set to January 1st, 1878 . . . . . . . . | 333 |

# TABLE VII.

## SHOWING THE NUMBER AND LOCATION OF HYDRANTS SET IN 1877.

| Street. | Location. | No. |
|---|---|---|
| Friend Street Ct. | 400 ft. S. from Friend Street | 1 |
| Oakwood Avenue | 35 ft. W. from Clinton Street | 1 |
| Oakwood Avenue | Corner of Wellington Street | 1 |
| Tremont Court | 146 feet N. from Tremont Street | 1 |

| | |
|---|---|
| Total hydrants set in 1877 | 4 |
| Previously set | 362 |
| Total Hydrants set to date | 366 |

# TABLE VIII.

## SHOWING THE NUMBER AND SIZE OF SERVICES PUT IN IN 1877.

| Month. | Size of Pipe. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 inch. | | 1½ inch. | | 1¼ inch. | | 1 inch. | | ¾ inch. | | Total. | |
| | No. | Length. | No. | Length. | No. | Length. | No. | Length. | No. | Length. | No. | Length. |
| April | | | | | | | 6 | 449.4 | 17 | 681.7 | 23 | 1,130.11 |
| May | 2 | 60.1 | | | | | 2 | 183 1 | 41 | 1,710.1 | 45 | 1,953.3 |
| June | | | | | | | 1 | 80 | 25 | 979.2 | 26 | 1,059.2 |
| July | | | | | | | 2 | 251.4 | 19 | 837.2 | 21 | 1,088.6 |
| Aug. | | | | | | | 2 | 190.9 | 30 | 1,002.5 | 32 | 1,193.2 |
| Sept. | | | | | 1 | 102 | 4 | 404.9 | 28 | 926.8 | 33 | 1,433.5 |
| Oct. | 1 | 92.6 | 1 | 216.5 | 1 | 212.11 | 1 | 8.6 | 33 | 1,317.2 | 37 | 1,847.6 |
| Nov. | | | | | | | 3 | 77.4 | 8 | 285.5 | 11 | 362 9 |
| Dec. | 1 | 25.2 | | | | | 1 | 101.4 | 23 | 740.10 | 25 | 867.4 |
| Tot's | 4 | 177.9 | 1 | 216.5 | 2 | 314.11 | 22 | 1,746.5 | 224 | 8,480.6 | 253 | 10,936. |

# TABLE IX.

## REPAIRS ON PIPES, GATES AND HYDRANTS FOR THE YEAR 1877.

| Month. | Size of Pipe. | | | | | | | | | | | Size of Gate. | | | | | | Hydrants. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 16 | 12 | 10 | 8 | 6 | 4 | 2 | 1½ | 1¼ | 1 | ¾ | 16 | 12 | 10 | 8 | 6 | 4 | |
| January | | | | | | 1 | | | | | | | | | | | | |
| February | 1 | | | 1 | 2 | 1 | | | | 2 | | | | | | | | |
| March | 3 | | | | 1 | 1 | | | | | 1 | | | | | 1 | | |
| April | 1 | | | 1 | 3 | | | | | | 2 | | | | | | | 3 |
| May | | | | 1 | 1 | 3 | | | | 1 | 3 | | | | | | | 3 |
| June | 1 | | | 1 | 2 | 5 | | | | 2 | | | | | 1 | | | 3 |
| July | 1 | | | 2 | 3 | 6 | | | 1 | | 1 | | | | | 1 | | 7 |
| August | | | | 1 | 2 | 4 | 1 | | | | | | | | | | | 1 |
| September | | | | | 4 | 3 | | | | | | | | | | 2 | | 2 |
| October | | | 1 | | 3 | 4 | | | | 1 | | | | | | | | 3 |
| November | 1 | | | 1 | 3 | 1 | | | | | | | | | | | 1 | 4 |
| December | 1 | | | 2 | 2 | 4 | | | | | | | | | | | 2 | 17 |
| Totals | 9 | | 1 | 10 | 26 | 33 | 1 | | 1 | 6 | 7 | | | | 1 | 4 | 3 | 43 |

## METEOROLOGICAL RECORD FOR SEPTEMBER, 1877.

| | 8, A. M. | | | 1, P. M. | | | 6, P. M. | | | 24 hours ending 8, A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.77 | 73° | 83 | 29.76 | 75° | 77 | 29.73 | 73° | 74 | 77° | 62° | 15° | 79°5 | .11 |
| 2 | 29.78 | 64 | 73 | 29.78 | 67 | 59 | 29.76 | 65 | 62 | 68.5 | 56 | 12.5 | 62.2 | .04 |
| 3 | 29.67 | 62.5 | 77 | 29.71 | 62.5 | 47 | 29.76 | 64 | 55 | 65 | 51 | 14 | 58 | .00 |
| 4 | 29.92 | 59.5 | 67 | 29.97 | 68.5 | 56 | 30.03 | 70 | 66 | 72.5 | 58 | 14 5 | 65.2 | .00 |
| 5 | 30.14 | 66 | 78 | 30.14 | 74 | 61 | 30.14 | 70 | 71 | 75 | 59 | 16 | 67 | .00 |
| 6 | 30.25 | 61 | 88 | 30 29 | 62 | 77 | 30.30 | 58.5 | 79 | 62 | 56 | 6 | 59 | .00 |
| 7 | 30.29 | 59 | 87 | 30.28 | 58 | 82 | 30.23 | 55.5 | 78 | 60 | 53 | 7 | 56.5 | .00 |
| 8 | 30.15 | 56 | 75 | 30.16 | 63 | 62 | 30.14 | 58 | 70 | 64 | 54 | 10 | 59 | .00 |
| 9 | 30.10 | 57 | 69 | 30.07 | 67 | 50 | 30.06 | 62 | 72 | 67 | 52 | 15 | 59.5 | .00 |
| 10 | 30.10 | 60 | 76 | 30.09 | 67.5 | 72 | 30.09 | 64 | 73 | 68 | 56.5 | 11.5 | 62.2 | .00 |
| 11 | 30.14 | 63.5 | 83 | 30.15 | 73.5 | 52 | 30.14 | 71 | 66 | 75 | 58 | 17 | 66.5 | .00 |
| 12 | 30.21 | 65 | 83 | 30.20 | 75 | 64 | 30.15 | 72 | 80 | 78 | 62 | 16 | 70 | .00 |
| 13 | 30.11 | 68 | 79 | 30.05 | 79 | 62 | 30.02 | 76.5 | 77 | 80 | 64.5 | 15.5 | 72.2 | .00 |
| 14 | 30.10 | 70 | 79 | 30.11 | 72 | 71 | 30.09 | 65 | 89 | 75 | 63.5 | 11.5 | 69 2 | .00 |
| 15 | 30.11 | 69 | 81 | 30.09 | 77 | 69 | 30.09 | 73 | 81 | 80 | 67 | 13 | 73.5 | .00 |
| 16 | 30.12 | 70 | 90 | 30.09 | 76 | 77 | 30.06 | 74 | 85 | 80.5 | 67 | 13.5 | 73.7 | .00 |
| 17 | 30.01 | 72 | 85 | 29.95 | 80 | 70 | 29.90 | 73 | 90 | 80.5 | 67.5 | 23 | 69 | .42 |
| 18 | 29.84 | 59 | 53 | 29.97 | 65 | 56 | 22.93 | 62.5 | 61 | 65.5 | 50 | 15.5 | 57.7 | .00 |
| 19 | 30.07 | 53.5 | 72 | 30.07 | 61.5 | 55 | 30.06 | 60 | 71 | 64 | 47 | 17 | 55.5 | .00 |
| 20 | 30.09 | 55 | 86 | 30.07 | 67 | 76 | 30.02 | 62 5 | 69 | 67 | 50 | 17 | 58.5 | .00 |
| 21 | 29.89 | 55 | 87 | 29.83 | 66 | 66 | 29.87 | 55 | 62 | 66 | 44.5 | 21.5 | 55.2 | .15 |
| 22 | 30.07 | 48.5 | 60 | 30.11 | 59 | 43 | 30.17 | 57 | 52 | 62 | 42 | 20 | 52 | .00 |
| 23 | 30.26 | 50 | 71 | 30.21 | 69 | 43 | 30.17 | 67 | 60 | 72.5 | 48 | 24.5 | 60.2 | .00 |
| 24 | 30.19 | 56 | 81 | 30.08 | 71.5 | 59 | 30.15 | 69 | 70 | 73 | 53 | 20 | 63 | .00 |
| 25 | 30.18 | 62 | 83 | 30.16 | 75 | 60 | 30.13 | 70 | 75 | 77 | 60 | 17 | 68.5 | .00 |
| 26 | 30.14 | 65 | 83 | 30.11 | 77 | 57 | 30.07 | 73 | 72 | 78 | 60 | 18 | 69 | .00 |
| 27 | 30.20 | 63 | 67 | 30.24 | 61 | 71 | 30.25 | 58 | 76 | 66 | 57 | 9 | 61.5 | .00 |
| 28 | 30.29 | 60 | 57 | 30.24 | 62 | 88 | 30.15 | 61.5 | 97 | 64 | 59 | 5 | 61.5 | .03 |
| 29 | 30.19 | 58.5 | 70 | 30.19 | 62 | 48 | 30.15 | 57 | 67 | 63 | 46 | 17 | 54.5 | .00 |
| 30 | 30.24 | 53 | 74 | 30.24 | 62 | 51 | 30.22 | 59 | 76 | 62.5 | 48 | 14.5 | 55.2 | .00 |

Monthly range . . . . . . . . . . . . . . . 38.5

Monthly mean . . . . . . . . . . . . . . . 62.8

Monthly rainfall . . . . . . . . . . . . . .75

## METEOROLOGICAL RECORD FOR OCTOBER, 1877.

| | 8, A. M. | | | 1, P. M. | | | 6, P. M. | | | 24 hours ending 8, A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.21 | 57° | 82 | 30.15 | 71° | 57 | 30.14 | 64° | 83 | 73°5 | 55° | 18°5 | 64°2 | .00 |
| 2 | 30.12 | 59 | 59 | 30.10 | 72 | 67 | 30.11 | 56 | 100 | 73 | 55 | 18 | 64 | .00 |
| 3 | 30.13 | 58 | 87 | 30.12 | 60 | 85 | 30.11 | 57 | 93 | 62 | 56 | 6 | 59 | .06 |
| 4 | 29.95 | 58 | 93 | 29.79 | 63 | 88 | 29.66 | 62.5 | 94 | 63 | 54 | 9 | 58.5 | 5.42 |
| 5 | 29.47 | 53.5 | 100 | 29.57 | 57 | 53 | 29.76 | 51.5 | 59 | 57.5 | 39 | 18.5 | 48.2 | .00 |
| 6 | 30.10 | 45 | 60 | 30.14 | 55 | 50 | 30.23 | 51 | 39 | 57 | 39 | 18 | 48 | .00 |
| 7 | 30.46 | 45 | 56 | 30.47 | 54 | 49 | 30.48 | 51 | 52 | 58 | 40 | 18 | 49 | .00 |
| 8 | 30.49 | 50.5 | 71 | 30.50 | 54 | 61 | 30.43 | 52 | 73 | 55.5 | 52 | 3.5 | 53.7 | .00 |
| 9 | 30.31 | 53.5 | 93 | 30.21 | 55 | 93 | 30.11 | 55 | 100 | 58 | 52.5 | 5.5 | 55.2 | 1.46 |
| 10 | 30.11 | 52 | 93 | 30.07 | 63 | 61 | 30.07 | 56 | 87 | 66 | 46 | 20 | 56 | .00 |
| 11 | 30.01 | 51 | 93 | 29.95 | 57.5 | 90 | 29.92 | 54 | 93 | 58 | 46 | 12 | 52 | .82 |
| 12 | 29.81 | 49 | 85 | 29.81 | 56.5 | 63 | 29.86 | 53.5 | 67 | 59 | 44 | 15 | 51.5 | .00 |
| 13 | 30.05 | 45.5 | 80 | 30.10 | 57 | 52 | 30.17 | 51.5 | 76 | 60 | 43 | 17 | 51.5 | .00 |
| 14 | 30.27 | 46 | 85 | 30.24 | 57 | 63 | 30.23 | 55 | 74 | 57 | 46.5 | 10.5 | 51.7 | .00 |
| 15 | 30.27 | 53 | 86 | 30.25 | 58 | 70 | 30.21 | 55 | 87 | 59 | 53.5 | 5.5 | 56.2 | .06 |
| 16 | 29.97 | 57 | 93 | 29.81 | 58.5 | 90 | 29.98 | 49 | 85 | 59.5 | 38.5 | 21 | 49 | .06 |
| 17 | 30.13 | 42 | 70 | 30.07 | 56 | 34 | 30.05 | 51.5 | 44 | 58 | 36.5 | 21.5 | 47.2 | .00 |
| 18 | 30.06 | 41 | 70 | 30.03 | 57 | 41 | 30.02 | 51 | 79 | 58 | 48 | 10 | 53 | .00 |
| 19 | 30.03 | 52 | 80 | 29.98 | 63.5 | 88 | 29.96 | 56 | 81 | 65 | 46 | 19 | 55.5 | .69 |
| 20 | 30.03 | 46 | 92 | 30.07 | 45 | 92 | 30.08 | 43 | 83 | 48 | 43 | 5 | 45.5 | .42 |
| 21 | 30.00 | 45 | 76 | 29.92 | 47 | 62 | 29.86 | 45 | 69 | 43 | 37.5 | 5.5 | 40.2 | .37 |
| 22 | 29.56 | 39 | 100 | 29.53 | 39.5 | 86 | 29.70 | 40 | 82 | 42 | 35 | 7 | 38.5 | .36 |
| 23 | 29.93 | 38 | 72 | 29.91 | 54 | 55 | 29.93 | 53 | 66 | 57.5 | 39 | 18.5 | 48.2 | .00 |
| 24 | 29.97 | 51 | 79 | 29.94 | 65 | 54 | 29.92 | 61 | 55 | 66.5 | 48.5 | 18 | 57.5 | .01 |
| 25 | 29.95 | 48 | 92 | 29.91 | 48 | 92 | 29.92 | 41 | 95 | 50.5 | 35 | 15.5 | 42.7 | .04 |
| 26 | 30.09 | 37 | 72 | 30.13 | 40.5 | 61 | 30.09 | 39 | 64 | 41 | 34 | 7 | 37.5 | .00 |
| 27 | 30.03 | 36 | 63 | 30.02 | 42 | 50 | 30.01 | 39 | 73 | 44 | 31 | 13 | 37.5 | .00 |
| 28 | 30.14 | 35 | 71 | 30.16 | 46 | 69 | 30.20 | 45 | 76 | 52 | 36 | 16 | 44 | .00 |
| 29 | 30.15 | 52 | 89 | 29.96 | 61 | 83 | 29.92 | 60 | 83 | 64.5 | 48 | 16.5 | 56.2 | .00 |
| 30 | 30.00 | 47.5 | 73 | 29.95 | 55 | 58 | 30.00 | 50 | 51 | 57.5 | 38.5 | 19 | 48 | .00 |
| 31 | 30.03 | 49.5 | 71 | 29.87 | 53 | 73 | 29.82 | 45 | 92 | 55 | 37.5 | 17.5 | 46.2 | .74 |

Monthly range . . . . . . . . . . . . . . . . . . 42.5
Monthly mean . . . . . . . . . . . . . . . . . . 50.5
Monthly rainfall . . . . . . . . . . . . . . . . . 10.45

## METEOROLOGICAL RECORD FOR NOVEMBER, 1877.

| Date. | 8, A. M. | | | 1, P. M. | | | 6, P. M. | | | 24 hours ending 8, A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.94 | 39° | 86 | 30.00 | 49° | 50 | 30.08 | 45°5 | 60 | 52° | 40° | 12° | 46° | .00 |
| 2 | 29.97 | 48 | 77 | 29.68 | 50 | 93 | 29.27 | 59 | 97 | 61 | 44 | 17 | 52.5 | 1.06 |
| 3 | 29.60 | 46 | 61 | 29.68 | 51 | 39 | 29.84 | 45 | 53 | 53 | 37 | 16 | 45 | .00 |
| 4 | 30.18 | 38 | 64 | 30.19 | 47 | 39 | 30.26 | 42 | 53 | 47 | 37 | 10 | 42 | .00 |
| 5 | 30.30 | 43.5 | 75 | 30.13 | 51 | 72 | 29.97 | 52 | 86 | 55 | 44 | 11 | 49.5 | .30 |
| 6 | 29.73 | 43 | 75 | 29.96 | 33 | 70 | 30.16 | 32 | 79 | 43 | 29 | 14 | 36 | .00 |
| 7 | 30.43 | 31.5 | 79 | 30.47 | 47 | 51 | 30.47 | 43 | 67 | 49 | 35.5 | 13.5 | 42.2 | .00 |
| 8 | 30.45 | 39 | 76 | 30.34 | 52 | 79 | 30.19 | 53.5 | 80 | 63 | 46 | 17 | 54.5 | 1.23 |
| 9 | 29.68 | 61 | 100 | 29.64 | 63.5 | 94 | 29.74 | 61 | 77 | 65 | 42 | 23 | 53.5 | .31 |
| 10 | 30.18 | 41 | 74 | 30.27 | 39 | 73 | 30.33 | 38 | 81 | 42 | 33 | 9 | 37.5 | .02 |
| 11 | 30.27 | 33 | 89 | 30.23 | 37 | 76 | 30.19 | 37 | 76 | 37 | 29 | 8 | 33 | .00 |
| 12 | 30.09 | 30.5 | 73 | 30.04 | 40.5 | 61 | 30.04 | 41.5 | 66 | 44 | 32 | 12 | 38 | .00 |
| 13 | 30.23 | 32.5 | 69 | 30.29 | 40.5 | 56 | 30.35 | 37 | 71 | 41 | 30 | 11 | 35.5 | .00 |
| 14 | 30.48 | 33 | 84 | 30.39 | 51 | 64 | 30.46 | 47.5 | 81 | 52 | 41.5 | 10.5 | 46.7 | .00 |
| 15 | 30.31 | 46 | 92 | 30.23 | 63 | 67 | 30.21 | 53.5 | 89 | 63 | 47 | 16 | 55 | .00 |
| 16 | 30.14 | 53 | 96 | 30.07 | 60 | 88 | 30.09 | 56 | 87 | 63.5 | 42 | 21.5 | 52.7 | .03 |
| 17 | 30.15 | 44 | 84 | 30.12 | 52 | 73 | 30.12 | 46 | 85 | 53 | 43 | 10 | 48 | .04 |
| 18 | 29.86 | 45.5 | 88 | 29.82 | 47 | 66 | 29.87 | 36 | 71 | 49.5 | 32.5 | 17 | 41 | .00 |
| 19 | 30.09 | 34 | 70 | 30.25 | 36.5 | 67 | 30.21 | 33.5 | 66 | 37.5 | 26 | 11.5 | 31.7 | .00 |
| 20 | 30.42 | 26.5 | 68 | 30.48 | 36 | 58 | 30.54 | 32 | 58 | 37 | 26.5 | 10.5 | 31.7 | .00 |
| 21 | 30.67 | 27.5 | 64 | 30.67 | 33.5 | 70 | 30.63 | 33 | 79 | 34 | 32 | 2 | 33 | .00 |
| 22 | 30.57 | 34 | 70 | 30.55 | 43 | 62 | 30.52 | 40 | 64 | 44 | 35 | 9 | 39.5 | .00 |
| 23 | 30.51 | 36 | 81 | 30.50 | 45 | 68 | 30.50 | 43 | 75 | 46 | 38 | 8 | 42 | .00 |
| 24 | 30.48 | 44 | 75 | 30.45 | 45 | 76 | 30.43 | 43.5 | 79 | 47 | 44 | 3 | 45.5 | .00 |
| 25 | 30.22 | 45.5 | 84 | 30.15 | 44 | 100 | 30.04 | 47 | 100 | 49.5 | 44.5 | 5 | 47 | 2.93 |
| 26 | 29.97 | 49 | 100 | 29.92 | 50.5 | 96 | 29.88 | 51.5 | 96 | 57 | 50 | 7 | 53.5 | 2.33 |
| 27 | 29.88 | 53.5 | 97 | 29.90 | 58 | 70 | 29.97 | 51 | 74 | 58.5 | 48 | 10.5 | 53.2 | .00 |
| 28 | 29.96 | 49 | 86 | 29.96 | 54 | 61 | 30.25 | 49 | 57 | 55 | 42 | 13 | 48.5 | .12 |
| 29 | 29.90 | 41.5 | 91 | 29.69 | 41.5 | 83 | 29.60 | 39 | 82 | 42 | 34 | 8 | 38 | .71 |
| 30 | 29.56 | 33.5 | 79 | 29.56 | 35 | 63 | 29.64 | 32 | 69 | 35 | 29.5 | 5.5 | 32.2 | .00 |

| | |
|---|---|
| Monthly range . . . . . . . . . . . . . . . . . . | 37.5 |
| Monthly mean . . . . . . . . . . . . . . . . . . | 43.5 |
| Monthly rainfall . . . . . . . . . . . . . . . . . | 9.08 |

## METEOROLOGICAL RECORD FOR DECEMBER, 1877.

| Date. | 8, A. M. | | | 1, P. M. | | | 6, P. M. | | | 24 hours ending 8, A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.89 | 30°5 | 73 | 29.94 | 33°5 | 51 | 30.08 | 28° | 52 | 34° | 17° | 17° | 25°5 | .00 |
| 2 | 30.39 | 18.5 | 52 | 30.43 | 27 | 58 | 30.44 | 24 | 61 | 29 | 17.5 | 11.5 | 23.2 | .00 |
| 3 | 30.46 | 22 | 65 | 30.36 | 36.5 | 55 | 30.30 | 35.5 | 62 | 38 | 23 | 15 | 30.5 | .00 |
| 4 | 30.34 | 29 | 77 | 30.34 | 43.5 | 52 | 30.31 | 40.5 | 60 | 44.5 | 29 | 15.5 | 36.7 | .36 |
| 5 | 30.13 | 44.5 | 84 | 29.98 | 52.5 | 93 | 29.83 | 55.5 | 90 | 58 | 45 | 13 | 51.5 | .53 |
| 6 | 29.46 | 46.5 | 85 | 29.49 | 44 | 56 | 29.67 | 43 | 67 | 42 | 31 | 11 | 36.5 | .00 |
| 7 | 30.14 | 29.5 | 55 | 30.20 | 34 | 40 | 30.22 | 33.5 | 47 | 36 | 29.5 | 6.5 | 32.7 | .00 |
| 8 | 30.12 | 35 | 76 | 30.05 | 44 | 48 | 30.06 | 39 | 60 | 45 | 30 | 15 | 37.5 | .00 |
| 9 | 30.13 | 30.5 | 73 | 30.15 | 34 | 62 | 30.23 | 30 | 46 | 36 | 20 | 16 | 28 | .00 |
| 10 | 30.33 | 21 | 85 | 30.29 | 33 | 59 | 30.20 | 34 | 53 | 39 | 22.5 | 16.5 | 30.7 | .05 |
| 11 | 30.12 | 29 | 83 | 29.98 | 36 | 80 | 29.90 | 39.5 | 68 | 42.5 | 30 | 12.5 | 36.2 | .00 |
| 12 | 30.14 | 36 | 67 | 30.19 | 42 | 58 | 30.28 | 37 | 63 | 43 | 31 | 42 | 37 | .02 |
| 13 | 29.95 | 39 | 82 | 29.61 | 47 | 81 | 29.58 | 45.5 | 57 | 51 | 27 | 24 | 39 | .01 |
| 14 | 29.92 | 27 | 51 | 30.04 | 27.5 | 58 | 30.14 | 26 | 33 | 36 | 26 | 10 | 31 | .00 |
| 15 | 30.06 | 36 | 50 | 30.00 | 46 | 43 | 29.94 | 43 | 51 | 49 | 37 | 12 | 43 | .00 |
| 16 | 29.85 | 47 | 76 | 29.95 | 53 | 64 | 30.14 | 43 | 51 | 53.5 | 32.5 | 21 | 43 | .00 |
| 17 | 30.14 | 36.5 | 90 | 29.98 | 50 | 68 | 29.93 | 50.5 | 69 | 54.5 | 24 | 30.5 | 39.2 | .00 |
| 18 | 30.52 | 24 | 67 | 30.62 | 29 | 60 | 30.68 | 29.5 | 65 | 36.5 | 25 | 11.5 | 30.7 | .00 |
| 19 | 30.60 | 36.5 | 81 | 30.40 | 43 | 71 | 30.30 | 46 | 69 | 48 | 37.5 | 10.5 | 42.7 | .00 |
| 20 | 30.20 | 48 | 85 | 30.22 | 49 | 60 | 30.40 | 39 | 60 | 54 | 24 | 30 | 39 | .00 |
| 21 | 30.66 | 24 | 74 | 30.66 | 32 | 69 | 30.65 | 31 | 54 | 37 | 25 | 12 | 31 | .00 |
| 22 | 30.53 | 35.5 | 67 | 30.49 | 39 | 51 | 30.47 | 37 | 67 | 42 | 28 | 14 | 35 | .00 |
| 23 | 30.53 | 28 | 65 | 30.51 | 38.5 | 60 | 30.50 | 34 | 75 | 41 | 27 | 14 | 34 | .00 |
| 24 | 30.39 | 27 | 63 | 30.31 | 41 | 49 | 30.28 | 37 | 71 | 42 | 26.5 | 15.5 | 34.2 | .00 |
| 25 | 30.19 | 27.5 | 64 | 30.14 | 40 | 60 | 30.10 | 34 | 70 | 40 | 26.5 | 13.5 | 33.2 | .00 |
| 26 | 29.98 | 27 | 82 | 29.96 | 40 | 65 | 29.96 | 35.5 | 66 | 41.5 | 27 | 14.5 | 34.2 | .00 |
| 27 | 30.00 | 28 | 76 | 30.02 | 44 | 59 | 30.03 | 37.5 | 76 | 44.5 | 28.5 | 16 | 36.5 | .00 |
| 28 | 30.09 | 30 | 77 | 30.13 | 38.5 | 68 | 30.13 | 35 | 71 | 40 | 28 | 12 | 34 | .00 |
| 29 | 30.13 | 27 | 75 | 30.05 | 39 | 56 | 30.06 | 37 | 69 | 42 | 30 | 12 | 36 | .00 |
| 30 | 29.89 | 34.5 | 80 | 29.70 | 33 | 79 | 25.59 | 29 | 83 | 35 | 25 | 10 | 30 | .02 |
| 31 | 29.45 | 24.5 | 74 | 29.39 | 34 | 34 | 29.94 | 26.5 | 63 | 35.5 | 17.5 | 18 | 26.5 | .00 |

| | |
|---|---|
| Monthly range . . . . . . . . . . . . . . . . | 41° |
| Monthly mean . . . . . . . . . . . . . . . | 34°8 |
| Monthly rainfall . . . . . . . . . . . . . . . . | .99 |

840132

# SEVENTH ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD

OF THE

# CITY OF LYNN,

FOR THE YEAR ENDING DEC. 31, 1878.

LYNN:
JOHN MACFARLANE & CO., PRINTERS,
No. 55 MUNROE STREET.
1879.

VDLA

# SEVENTH ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD

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## FOR THE YEAR ENDING DEC. 31, 1878.

LYNN:
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No. 55 MUNROE STREET.
1879.

# PUBLIC WATER BOARD.

## OFFICERS FOR 1879.

**EDWIN WALDEN**, *President*,
TWO YEARS.

**JAMES PURINTON**,
ONE YEAR.

**THOMAS B. NEWHALL**,
THREE YEARS.

**DAVID H. SWEETSER**,
FOUR YEARS.

**JAMES N. BUFFUM**,
FIVE YEARS.

*Superintendent and Clerk*,
DANIEL WALDEN.

*Water Registrar*,
SIMON J. RONEY.

*Pumping Engineer*,
WILLIAM H. MESSINGER.

*Inspector*,
CHARLES H. CLIFFORD.

*Foreman of Pipe Work*.
EDWIN MAXWELL.

# ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD.

OFFICE OF PUBLIC WATER BOARD,
*February 17, 1879.*

In compliance with a requirement of the Ordinance relating to the water supply of the city, the Public Water Board hereby present to the City Council their Seventh Annual Report. In connection herewith will be found the Reports of the Superintendent of the Works and of the Water Registrar, as submitted to the Board at the beginning of the present year. These reports are so full in the information they afford, both as to the condition of the works and the financial standing of the department, that but little can be added without repeating what is already well and clearly stated.

The Superintendent's Report contains carefully prepared tables showing the rain fall for the year, the consumption of water by daily and monthly averages, the varying condition of the water sources, the record of the pumping works, and such other information relating to the Department as will assist in determining its efficiency, its capacity of supply, and its general condition.

A very instructive table is presented, showing the amount of the rainfall in each of the last five years, and the quantity of water received into the storage basins which could have been made available for use. There is also added a meteorological record for the year 1878, compiled from daily observations and prepared with much labor. It is the purpose of the Board to continue this record, and its publication. Although it may be regarded as having but little present value, it is only by a beginning that a continuous record, covering a considerable period of years, can become useful and instructive.

The change in the "Rules and Regulations," by which the board are required to elect, annually, a Water Registrar, also provides that that officer, under the direction of the Superintendent, shall have charge of the accounts of the department. Heretofore, these duties were performed by the Superintendent in his capacity as Clerk of the Board, he having an assistant to aid him. The statements showing the receipts and expenditures for the past year, the cost of the works, together with such other matters as have connection with that branch of the department, appear, therefore, as a part of the report of the Registrar, and the Clerk's report, which could be only a record of the business meetings of the Board, is omitted.

The duties assigned to the Superintendent and

Registrar have been satisfactorily performed. These officials hold no sinecure positions. There is a demand upon their time and attention every working day in the year. The regular office hours of the Registrar make the time of a full working day. The bills to water takers sent out each six months number more than five thousand; and the total number of bills made and collected in a year equals, if it does not exceed, the number of ordinary city tax bills. While the amount collected may not be larger than a fifth of the city tax levy, it should be remembered that the labor of making and collecting tax bills does not consist in the amount to be dealt with, but depends rather upon the number who are expected to pay. The Registrar is also required to receive all applications for water, and to make record thereof; to enter the names of all persons having service pipes connected with their premises, showing number and location upon the street, with plan and measurements, that they may be readily found in case of accident or needed repairs. In short, a variety of important clerical work is required of this officer; to neglect which would involve the department in a confusion of its affairs which it would be difficult to again make certain.

Much more important are the duties of the Superintendent. Under his general direction the variety of office work is carried forward. The supervision of fifty-three miles of distribution pipes fall under his care. Three hundred and eighty-one fire hydrants, three hundred and fifty stop gates, and thirty-nine hundred services are connected therewith. Some attention, also, must be given to the storage and distributing reservoirs. The engine house must be visited frequently, and a store of supplies for the pumping machinery be kept on hand. The workshop must be furnished with tools and materials for the work the department is called upon to do. In the busy season there must be laborers employed, and planning and arrangement for the prosecution of out-door work. For the well-working of so important a department of city affairs the Superintendent is largely held responsible. The many duties the position imposes are not borne without care and anxiety. A gate closed which should be open, the failure of a hydrant to work effectively, an interruption in the supply of water from whatever cause, brings down upon the Superintendent the public censure. The public does not too willingly accept explanations and apologies. To win success in a line of duties so various and so responsible, one must have his heart in his work. A liking for the work in hand, an experience to guide, some knowledge of machinery and of mathematics, good judgment and ability to act promptly, are some of the qualifications to be desired in a superintendent of water works. We think it our duty to add, that the success which has attended the conduct of the Water Department in this city is in good part due to the industry, faithfulness, and intelligent supervision of that officer, and to the capable and faithful assistants who have worked under his direction.

## PUMPING ENGINES.

The Leavitt pumping engine connected with the works keeps up the remarkable duty heretofore reported. The Superintendent, in his report, calls attention to the small outlay which has been required to keep it in repair, and the economy with which it has done its work.

In our last report we called the attention of the City Council to the necessity that existed for duplicating the pumping machinery. The reasons then given have acquired additional force. Every year adds two or three hundred to the list of water takers. With the anticipated improvement in business affairs will come a considerably increased consumption of water. The small engine now relied upon to supply the reservoir, in case of accident to the large one, is not equal to the work which would be required. A full year will be needed to contract for, build and set up, an engine of the capacity desired. The low prices now prevailing for heavy machinery, and the low rate of interest at which a loan can be effected for the purchase, suggest that no desire to postpone expenditure should be indulged in a matter of so much importance. Hoping for a favorable consideration of the suggestions of the Board in this matter, we leave the responsibility with the City Council.

## WATER SOURCES.

The supply of water during the year was abundant, and of good quality. The rainfall was unusually large, exceeding by twelve inches that of any year since the works were constructed. The quantity of water received into the storage basins was about fifty per cent. of the entire rainfall upon their watersheds.

The dam at Breed's Pond has been raised during the year about three feet. The storage capacity of the pond is thereby increased about forty millions of gallons, equal to a month's supply. With a full pond the depth of water at the gate house will be twenty feet.

A waste way has also been built down the hillside, reaching from the overfall to Oak street, and a granite coping has been set on the water side.

The raising of the dam required the building up of the gate house. The roof was lifted, the stone work, as far down as the gate chamber, was removed, and brick work substituted. The interior was thereby enlarged and made more convenient.

The old bridge to the gate house has been removed, and a new and more substantial structure occupies its place. The score of old and badly dilapidated buildings connected with the Breed's Pond property, have all been sold and converted to other uses.

The improvements contemplated at this point will find completion early the coming season. The work in hand will much improve the appearance of the dam and its surroundings, and will be accomplished at a moderate cost.

The supply of water to the city for the past year has been mainly drawn from Breed's Pond. Birch Pond, during the summer months, was again unfavorably affected by microscopic vegetable growth. At the present time the appearance of the water indicates a good condition, and its use, for a month or two, will insure the filling of Breed's Pond to its fullest capacity.

## WATER IN SAUGUS AND SWAMPSCOTT.

During the year a contract was made by the Town of Saugus and the City of Lynn, by the terms of which the former is entitled to a supply of water, in the village of East Saugus, through the works of this city. The expense of laying distribution and service pipes is to be borne by the Town of Saugus. The water rates are to be the same as are charged in this city. All collections are to be made through this office; and the receipts, without any abatement, are to be regarded as a part of the income of this department. The care, and ordinary repair, of the works in Saugus, are to be assumed by the City of Lynn.

About a mile and a quarter of pipes have been laid, and the distribution reaches the most thickly settled portion of the village. The connection with the works of the city was made late in the Fall, and twenty-five services were put in. More will be added when the season for out-door work is reached. The income from water takers in East Saugus will of course be small, but will increase as the years go on. The expense of supplying them will also be small, and could scarcely be reckoned. If both parties to the contract are benefited, it is well that it exists.

A small neighborhood in Swampscott is also accommodated by these works. The takers are few, but the convenience of an abundant supply was regarded by them as worth the cost of laying seventeen hundred feet of pipe to obtain it. A short time only will pass before the small but thrifty towns just over our borders will feel the necessity for a more general supply. In almost every direction our city distribution reaches their very boundaries, and arrangements will soon be possible whereby the advantages of a public water supply will be common to them all.

## RECEIPTS AND EXPENDITURES.

The books of the Registrar show that the receipts of the department for the past year were $69,894.81.

Deducting therefrom the receipts for extra pipe laid, labor, etc., amounting to $2,324.67, the legitimate income will be found to be $67,570.14. The amount uncollected at the close of the year was $226.09 larger than for the previous year; which, added to the amount already given as cash receipts, carries the revenue for the year, less all abatements made, to $67,796.23. The revenue for 1877 was $63,792.46, showing an increase in revenue for the year 1878, of $4,003.77.

The maintenance account shows an increase in the expenses during the year of $628.07, the total expenditure for maintenance being $9,680.45. The interest on Water Debt was $58,790; total for interest and maintenance $68,470.45. Deficiency of income to meet interest and maintenance, $674.22.

The construction account was increased during the year $18,351.32. Of this amount $10,636.61 was expended in laying distribution pipes, and the setting of hydrants and stop-gates. $4,491.67 was required to meet the cost of new services, and short lines of small size pipe laid in courts and places; and $1,663.89 was expended in raising the dam at Breed's Pond.

The amount of distribution pipes laid the past year was considerably in excess of the recommendations of the Board. The return from water takers on these new lines is very small, and for some years to come the income will not equal the interest on the outlay.

The rule adopted by the Board several years since, which requires a reasonable assurance of an immediate income equal to the interest on the outlay, we still think a good one. As the action of the City Council in regard to petitions for additional outlays is law to the Board, the responsibility for unprofitable investment is with those who have the authority to require them to be made.

## COST OF THE WORKS.

As will be seen by the detailed statement of the Registrar, the cost of the works, January 1, 1879, after deducting receipts from water takers for extra pipe laid, labor, etc., was $950,339.25. The accounts of the Water Department show that the total amount of deficiency in revenue to meet the cost of maintenance and interest payments, is $66,670.48, which sum, added to the amount already given as the *net* cost of the works, carries the *gross* cost to $1,017,009.73. Of this amount, $921,500 is represented by the water debt; leaving $95,509.73 to be otherwise accounted for. In January, 1871, there was transferred to construction account, from unappropriated funds in the city treasury, the sum of $22,929.34; in 1875, the premium received on replacing a portion of the city loan was carried to the same account, amounting to $16,200; and in 1878 the premium on a renewal of a part of the water loan, amounting to $6,750.00, became a credit to that account. Deducting the amount of these sums from the gross cost of the works, there remains a balance of $49,630.39, which amount represents the appropriations and transfers made by the City Council for the extension of the works, and to meet deficiencies in income for interest payments, other than as above referred to. The facts above given may be condensed into the following statement:

| | | |
|---|---|---|
| Net cost of city works to Jan. 1, 1879 | | $950,339 25 |
| Total deficiency of income to meet interest and maintenance . . . . | | 66,670 48 |
| Total gross cost of the works to date | | $1,017,009 73 |
| This expenditure has been provided for by the issue of bonds and notes of the city, now representing the water debt, to the amount of . . . . . . . . . | $921,500 00 | |
| Unappropriated funds in city treasury, January, 1871, transferred to construction account . . . . . . . . . | 22,929 34 | |
| Premium on sale of city bonds, 1875, to construction account . . . . . . . | 16,200 00 | |
| Premium on sale of water bonds, 1878, to construction account . . . . . . | 6,750 00 | |
| Appropriations and transfers by City Council to construction account, other than as above given . . . . . . . | 49,630 39 | |
| | | $1,017,009 73 |

## FINANCIAL STANDING.

From the foregoing statements regarding the cost of the works, the interest on the water debt, the maintenance account, and the receipts of the department, it will be plainly seen that the water works of the city are now wholly self-supporting. Nor is it likely that any outlay will hereafter be made, either to increase the water supply or the capacity of the works, that will increase the interest account to an amount larger than the balance of receipts, after deducting the annual expenses for maintenance.

If the present supply should be supplemented by bringing forward to Birch Pond the waters of either Hawkes Brook or Penny Brook, and another engine should be added to the pumping works, the receipts will still be sufficient, if no reduction of rates be made, to meet the interest on the entire cost of construction and the expenses of maintenance.

$350,000 of the water loan, bearing seven per cent. interest, matured in July last. The City Treasurer provided for this payment by the sale of an equal amount of five per cent. bonds, receiving thereon a premium of about two per cent., or $6,750.00. The interest on the water debt the present year, will therefore be decreased $7,000, and the total interest payments for the current year will drop to $51,790. If we estimate the maintenance account for the year at $10,000, the total requirement for these two items will be $61,790. The revenue of the department for the past year was $67,796.23; and the gain in receipts over those of the preceding year, was $4,003.77. To estimate the revenue of the present year at

$70,000 will not be regarded as naming figures which probabilities do not warrant. If these estimates shall prove correct, the excess of revenue above the interest payments and expenses of maintenance will be not less than $9,000, which sum will be carried to the sinking fund, already established, for the reduction of the water debt.

| | |
|---|---|
| EDWIN WALDEN,<br>JAMES PURINTON,<br>THOMAS B. NEWHALL,<br>DAVID H. SWEETSER,<br>JACOB M. LEWIS, | *Public Water Board.* |

# REPORT OF THE WATER REGISTRAR.

*To Hon. Edwin Walden, President of Public Water Board:*

DEAR SIR: — In compliance with the requirements of the City Ordinance, I herewith respectfully submit the Report of the Water Registrar for the year ending December 31, 1878.

## SERVICES.

The whole number of services in use on the first of January 1878, was 3,667; number of new services put in during the year, was 231; number discontinued, — the buildings being moved, — was 6; leaving total number of services in use, January 1, 1879, 3,892.

The city is furnishing water to 25 services in East Saugus, and to 9 in Swampscott. The number of services shut off for non-payment of water rates, was 55; let on again by payment of rates and fines, 11; number let on without payment of the usual fines, (property changed owners), 5; number still remaining off, 39; number let on that was shut off before 1878, 12; services shut off by request, (premises vacant), 128; let on again, (premises reoccupied), 52; number still remaining off, 76.

All places supplied with city water have been visited during the year, and all leaky fixtures repaired.

The ratio of increase in the number of services for the last four years has been as follows:

| | | | |
|---|---|---|---|
| In 1875 | 5.25 per cent. | In 1877 | 7.60 per cent. |
| 1876 | 6.54 " | 1878 | 6.14 " |

There is now due on account of water, including metre rates due the first of January, 1879, for the last quarter, the sum of $2,739.22; on account of extra pipe, labor, etc., the sum of $238.99.

## RECEIPTS FOR THE YEAR 1878.

| | | |
|---|---|---|
| For use of water for all purposes | $67.461 14 | |
| For fines — water shut off and let on again | 46 00 | |
| For rents | 63 00 | |
| | | $67,570 14 |
| Extra pipe, labor, etc. | | 2,324 67 |
| Total receipts | | $69.894 81 |

All of which has been paid into the city treasury.

## IVE STATEMENT OF REVENUE FOR 1878.

| | | |
|---|---|---|
| cted in 1878 . . . . . . . . | $67,570 14 | |
| ollected . . . . . . . . . . . | 2,739 22 | |
| | | $70,309 36 |
| unt due at beginning of the year | | 2,513 13 |
| 1878 . . . . . . . . . . . . | | $67,796 23 |
| r 1877 . . . . . . . . . . . . | | 63,792 46 |
| of revenue for 1878 . . . . . . | | $4,003 77 |

## TEMENT OF INTEREST, MAINTENANCE AND REVENUE, TO JANUARY 1, 1879.

| | | |
|---|---|---|
| est for 1878 . . . . . . . . . . . . | $58,790 00 | |
| tenance for 1878 . . . . . . . . . . | 9,680 45 | |
| | | $68,470 45 |
| enue for 1878 . . . . . . . . . . . | | 67,796 23 |
| ficiency of revenue to meet interest and maintenance . . . . . . . . . . . . | | 674 22 |
| ficiency previously accrued . . . . . . | | 65,996 26 |
| tal deficiency of reveuue to meet cost of maintenance and interest to date . . . | | $66,670 48 |

## EXPENDITURES FOR THE YEAR 1878.

### MAINTENANCE.

| | | |
|---|---|---|
| Salaries and office expenses . . . . . . . | $3,208 45 | |
| Repairs on services and miscellaneous . . | 781 94 | |
| Repairs on mains, hydrants and gates . . | 675 46 | |
| Repairs on reservoir . . . . . . . . . . | 94 50 | |
| Labor at Breed's Pond . . . . . . . . . | 16 67 | |
| Labor at Birch Pond . . . . . . . . . . | 3 70 | |
| Repairs on Engine House . . . . . . . | 186 98 | |
| Pumping, wages, coal, oil, waste, etc. . . | 3,826 67 | |
| Stable, hay, grain and repairs . . . . . . | 886 08 | |
| Total maintenance . . . . . . . . . | | $9,680 |

### CONSTRUCTION.

| | | |
|---|---|---|
| Services and court mains . . . . . . . . | $4,491 67 | |
| Distributing mains, hydrants and gates . . | 10,636 61 | |
| Meters . . . . . . . . . . . . . . . . | 314 98 | |
| Land damages at Birch Pond . . . . . . | 820 17 | |
| Breed's Pond, raising dam . . . . . . . | 1,663 89 | |
| Engineering . . . . . . . . . . . . . | 100 00 | |
| Engine House and land . . . . . . . . | 324 00 | |
| | | $18,351 3 |

## TOTAL EXPENDITURES TO JANUARY 1, 1879.

| | | |
|---|---|---|
| Breed's Pond, land and buildings | $31,965 80 | |
| Birch Pond and land | 43,630 07 | |
| Pipe, conduit and right of way | 43,785 98 | |
| Reservoir and land | 131,482 30 | |
| Force main and land | 24,614 00 | |
| Engine House and land | 55,436 79 | |
| Engine and boilers | 63,444 72 | |
| Distributing mains, hydrants and gates | 466,247 39 | |
| Services and court mains | 106,840 34 | |
| Meters | 4,585 55 | |
| Workshop and stable | 1,696 65 | |
| Engineering | 8,564 99 | |
| | | $982,294 58 |

### CREDIT.

| | |
|---|---|
| By amount received for extra pipe, etc. | 31,955 33 |
| Total net expenditures to date | $950,339 25 |

All of which is respectfully submitted.

SIMON J. RONEY,

*Water Registrar.*

## STATEMENT

### SHOWING THE NUMBER AND KINDS OF FIXTURES TAINED WITHIN THE PREMISES OF WATER-TAKERS DECEMBER 31, 1878, AS COMPARED WITH THE PREV YEAR.

| Kind of Fixtures. | 1877. | 1878. | Increase. | Dec |
|---|---|---|---|---|
| Faucets | 6,870 | 7,307 | 437 | |
| Bath Tubs | 393 | 422 | 29 | |
| Water Closets — pan | 976 | 1.071 | 95 | |
| Water Closets — hopper | 105 | 71 | | |
| Water Closets — self-acting hopper | 7 | 2 | | |
| Hand Hose | 972 | 1,038 | 66 | |
| Totals | 9,323 | 9.911 | | |

| | | |
|---|---|---|
| | *Amount brought forward,* | $54,690 80 |
| 2 | Laundries . . . . . . . . . . . . . . . . . . | 93 18 |
| 381 | Fire Hydrants and 4 Reservoirs . . . . . . . | 10,000 00 |
| | Building purposes . . . . . . . . . . . . . . | 65 28 |
| | Filling Cistern and Tanks . . . . . . . . . | 16 65 |
| | Watering Streets . . . . . . . . . . . . . . | 2,520 23 |
| | Filling Goldfish Pond . . . . . . . . . . . | 75 00 |
| | Total receipts for water . . . . . . . . . . . . . | $67,461 14 |

## STATEMENT

SHOWING THE YEARLY REVENUE OF THE WATER DEPARTMENT, SINCE THE FIRST INTRODUCTION OF WATER INTO THE CITY, IN 1871.

| | |
|---|---|
| From October 1, 1871, to January 1, 1872 . . . . . | $8,989 00 |
| From January 1, 1872, to January 1, 1873 . . . . . | 27,568 16 |
| From January 1, 1873, to January 1, 1874 . . . . . | 47,992 61 |
| From January 1, 1874, to January 1, 1875 . . . . . | 53,545 61 |
| From January 1, 1875, to January 1, 1876 . . . . . | 52,553 26 |
| From January 1, 1876, to January 1, 1877 . . . . . | 60,867 12 |
| From January 1, 1877, to January 1, 1878 . . . . . | 64,002 50 |
| From January 1, 1878, to January 1, 1879 . . . . . | 67,570 14 |
| | $383,088 40 |

## STATEMENT

SHOWING THE NUMBER AND KINDS OF FIXTURES CO TAINED WITHIN THE PREMISES OF WATER-TAKERS, DECEMBER 31, 1878, AS COMPARED WITH THE PREVIO YEAR.

| Kind of Fixtures. | 1877. | 1878. | Increase. | Decrea |
|---|---|---|---|---|
| Faucets | 6,870 | 7,307 | 437 | |
| Bath Tubs | 393 | 422 | 29 | |
| Water Closets — pan | 976 | 1,071 | 95 | |
| Water Closets — hopper | 105 | 71 | | 34 |
| Water Closets — self-acting hopper | 7 | 2 | | 5 |
| Hand Hose | 972 | 1,038 | 66 | |
| Totals | 9,323 | 9,911 | | |

# TABLE

## EXHIBITING THE CLASS OF PREMISES TO WHICH METERS ARE ATTACHED.

| Name. | Class. | Size. | | | | |
|---|---|---|---|---|---|---|
| | | ⅝ | ¾ | 1 | 1½ | 2 |
| Eastern Railroad Company | | | | 1 | | 1 |
| B. R. B. & L. R. R. Company | | | 2 | | | 1 |
| L. & B. Railway Company | | | | 1 | | |
| Samuel M. Bubier | Engine. | | | 1 | | |
| F. J. Kidder | " | | | 1 | | |
| P. P. Tapley & Co. | " | | | 1 | | |
| Augustus B. Martin | " | | | 1 | | |
| Patrick Lennox & Co. | " | | | 1 | | |
| L. B. Frazier | " | | | 1 | | |
| S. A. Guilford, agent | " | | | | 1 | |
| Exchange Engine Co. | " | | | 1 | | |
| Swain, Fuller & Co. | " | 1 | | | | |
| Albert F. Goodwin | " | 1 | | | | |
| John T Moulton | " | | | 1 | | |
| Samuel M. Bubier | " | | | 1 | | |
| A. M. Wooldredge | " | | | 1 | | |
| James N. Buffum & Co. | " | | | 1 | | |
| F B. Mower & Co. | " | | 1 | | | |
| Jerome Ingalls | " | | | 1 | | |
| Albert T Goodwin | " | 1 | | | | |
| Central Power Co | " | 1 | | | | |
| R. W. Drown & Son | " | | 1 | | | |
| Keene Brothers | " | | | 1 | | |
| William A. Kelley & Son | " | | | 1 | | |
| Bay State Wheel Co. | " | | | 1 | | |
| Blaney Bros. | " | | | 1 | | |
| D. H & C. S. Sweetser | " | | | 1 | | |
| Pevear & Co. | " | | | 1 | | |
| John McNai | " | | 1 | | | |
| Charles G. Clark | " | | | 1 | | |
| Baldwin & Silliman | " | | 1 | | | |
| Edwin H. Johnson | " | | 1 | | | |
| J C. Bennett & Barnard | Factory. | | 1 | | | |
| Charles B. Tebbetts | " | | | 1 | | |
| Shute & Faulkner | " | | | 1 | | |
| A. M. & J. H. Preble | " | 1 | | | | |
| E. H. Newhall & Co. | " | 1 | | | | |
| Pevear & Co. | " | | | 1 | | |
| W. L. Haskell & Co. | " | 1 | | | | |
| Moses Norris & Son | " | | | 1 | | |
| *Carried forward* | | 7 | 8 | 25 | 1 | 2 |

[TABLE EXHIBITING THE CLASSES OF PREMISES TO WHICH METERS ARE ATTACHED. — *Continued.*

| Name. | Class. | Size. | | | | |
|---|---|---|---|---|---|---|
| | | ⅝ | ¾ | 1 | 1½ | 2 |
| *Brought forward* | | 7 | 8 | 25 | 1 | 2 |
| Luther S. Johnson | Factory. | | | 1 | | |
| A. M. Wooldredge | " | | | 1 | | |
| Isaac M. Attwill | " | 1 | | | | |
| Benjamin Dupar & Co. | " | 1 | | | | |
| George D. Whittle | " | 1 | | | | |
| Joseph Davis & Co. | " | | 1 | | | |
| J. Doherty & Co. | " | | 1 | | | |
| William Claflin | " | 1 | | | | |
| Mower Bros. | " | 1 | | | | |
| B. F. Doak & Co. | " | | 1 | | | |
| Frank W. Breed | " | | 1 | | | |
| John T. Moulton | " | 1 | | | | |
| B. F. Spinney | " | 1 | | | | |
| P. P. Sherry | " | 1 | | | | |
| Charles Buffum | " | 1 | | | | |
| F. B. Mower | " | 1 | | | | |
| P. J. Hanley | " | 1 | | | | |
| Charles B. Clough | " | 1 | | | | |
| George W. Clark | " | 1 | | | | |
| Lewis & Collyer | " | 1 | | | | |
| Spinney & Caldwell | " | 1 | | | | |
| Pierce & Ellis | " | 1 | | | | |
| Kimball Bros. | " | 1 | | | | |
| John Donallen & Son | " | | | 1 | | |
| C. H. Bacheller & Co.<br>Thomas C. Murphy | " | 1 | | | | |
| Raddin & Lindsey<br>H. L. Porter | " | 1 | | | | |
| Bartlett & Doak | " | 1 | | | | |
| Charles G. Clark & Co. | " | | | 1 | | |
| I. C. Breed | " | 1 | | | | |
| James Phelan | " | | 1 | | | |
| S. M. Bubier | " | | | 1 | | |
| Joseph N. Smith | " | 1 | | | | |
| John Dougherty | " | 1 | | | | |
| C. B. Lancaster | " | 1 | | | | |
| C. H. Aborn & Co. | " | 1 | | | | |
| Eugene Barry | " | | 1 | | | |
| Breed, Dole & Co. | " | | 1 | | | |
| T. P. Richardson & Co. | " | | 1 | | | |
| D. L. Brown & Oliver | " | | 1 | | | |
| E. H. Stowell & Rhodes | " | 1 | | | | |
| George W. Downing | " | 1 | | | | |
| John Mahon & Sons | " | | | 1 | | |
| B. F. Doak & Co. | " | | | 1 | | |
| C. A. Collin & Co. | " | | 1 | | | |
| *Carried forward* | | 34 | 18 | 32 | 1 | 2 |

[TABLE EXHIBITING THE CLASSES OF PREMISES TO WHICH METERS ARE ATTACHED. — *Concluded.*]

| Name. | Class. | Size. | | | | |
|---|---|---|---|---|---|---|
| | | ⅝ | ¾ | 1 | 1½ | 2 |
| *Brought forward* | ............ | 34 | 18 | 32 | 1 | 2 |
| C. S. Sweetser | Factory. | | | 1 | | |
| Morgan & Dore | " | | | 1 | | |
| E. W. & C. F. Mower | " | 1 | | | | |
| W. H. Trask & Co. | " | | | 1 | | |
| Fred. P. Burnham | " | 1 | | | | |
| B. F. Spinney | " | 1 | | | | |
| Healey Bros. | " | 1 | | | | |
| G. E. Marsh & Co. | " | | 1 | | | |
| Charles D. Pecker | " | | | | 1 | |
| A. F. Smith | " | | 1 | | | |
| H. M. Smith | " | | | 1 | | |
| Frank W. Breed | " | | 1 | | | |
| Odd Fellows' Hall | Building. | | | 1 | | |
| A. C. Blethen | " | | 1 | | | |
| G. B. French | " | | | 1 | | |
| Silsbee & Pickford | " | | 1 | | | |
| Kirtland House | Hotel. | 1 | | | | |
| Amos E. Mower | Liv. Stable. | | | | | |
| L. E. Smith | " | 1 | | | | |
| A. D. Wallace | " | 1 | | | | |
| W. L. Selman | " | 1 | | | | |
| A. B. Breed | " | 1 | | | | |
| C. R. Blake | Laundry. | 1 | | | | |
| B. J. Berry | Dwelling. | 1 | | | | |
| Total | ............ | 45 | 23 | 38 | 2 | 2 |

# REPORT OF THE SUPERINTENDENT.

*Hon. Edwin Walden, President of the Public Water Board:*

In compliance with the City Ordinance, I have the honor to present, herewith, the Annual Report of the Superintendent for the year ending December 31, 1878.

## PONDS.

From the high stage of the ponds at the beginning of the year, and the abundant rains, they were both filled, and the water began to run to waste on the 28th of January, and continued to run, varying from one-half inch to three and one-half inches in depth, till March 26th, when the waste was stopped by puting in additional flash boards. On the 29th of April both ponds again commenced to run over the flash boards, and continued to run till the 9th of May, when the waste ceased, water having wasted from Breed's Pond for fifty-five days, and from Birch Pond for sixty-eight days. In December, the flash boards having been removed from Birch Pond, there was a slight waste from that pond for a few days.

There have been slight repairs at the waste way of Birch Pond, and the bridges and roof of the gate [illegible] is now in good condition [illegible] between the pond [illegible] and fencing.

At [illegible] B[illegible] Pond was repaired [illegible] waste way was built [illegible] over the waste weir. [illegible] the past two years [illegible] quantity of water [illegible] the waste weir had [illegible] that the building [illegible] the water became a mat- [illegible] the water pos- [illegible] to raise the [illegible] higher than [illegible] the event of a [illegible] street, and the bottom carefully paved. A wing wall against the side-hill at the waste weir has been built for the better protection of that side of the pond, and a stone coping has been put around the dam two feet high, set upon a solid foundation of masonry, resting upon the original puddle wall, the old gate house has been taken down, and the gate chamber carried up to a level with the top of the coping to the dam, and a new brick gate house erected in place of the old one. A new truss bridge has also been built to connect the gate house with the dam. Owing to the lateness of the season when the work was commenced, the earth filling on the top of the dam is only partially completed, and will be finished as soon as the weather permits. When the work is finished it will add much to the appearance of the pond, and increase the storage capacity about forty million gallons.

By virtue of an order of the City Council, the buildings below the dam, at Breed's Pond, have all been sold, and have nearly all been taken down or removed. Considerable filling and grading will be required to give the place a respectable appearance.

The rainfall for the year has been largely in excess of any previous year since the water works were built, and the ponds have consequently been kept at a greater average height than usual. The total yield of the water shed, that could have been made available for use, has been equal to 28.57 inches over the entire area, exclusive of water surfaces, or 49.82 per cent. of the rainfall.

In Table III, annexed, you will find the amount of rainfall on the water shed of both ponds, the amount of water used and wasted, and the per centage of the rainfall available for use, from 1874 to 1878, both inclusive.

## RESERVOIR.

The reservoir is in good condition. The only expense incured for the year has been the cleaning of the walk and road from weeds and grass, and painting the gate house, bridge, etc.

## PUMPING STATION.

The Engine House has received some necessary repairs, and all the wood and iron work has been thoroughly painted. A new fence has been built around the sides and rear of the lot, and with a suitable fence in front, which I trust will be built the coming season, the general appearance of the station will be much improved.

The engine and boilers are pronounced, by the engineer in charge, to be in good condition. The engine [illegible] to work with the same good economy [illegible] in previous years. It is now [illegible] days of six years since the engine was [illegible]. Five years ago it was accepted by the Board, and during this time the repairs upon the engine, separate from the pump and boilers, do not amount to one hundred dollars; and for the last eighteen months not one dollar has been paid for repairs. Notwithstanding this favorable record, there remains the danger of a sudden break-down when least expected. I desire, therefore, to again call your attention to the necessity of a duplicate pumping engine to place the works in a position to meet the requirements of the city in case of serious accident. The loss of interest, in case no accident should happen, would be more than compensated in the feeling of security given, and would be as nothing in comparison to the inconvenience to our citizens which would be sure to follow a break of any considerable magnitude as we are now situated.

## PIPES.

We have laid during the year 11,014 feet of distributing mains, in different parts of the city, and have set fifteen hydrants and fifteen gates in connection with the same; have also set an eight inch gate on Boston street, near the Saugus line, and three four-inch blow-off gates at suitable places on the new extension of pipe. 1,230 feet of 1¼ inch and 1½ inch pipe has been laid in various courts as mains, and five gates set in connection with the same. 230 services and one stand pipe for fire purposes have been put in during the year. 91 leaks in pipes, 7 gates, and 19 hydrants have been repaired; 23 new gate boxes, and 4 new service boxes, have been set to replace old ones that were decayed. For items and particulars of work done, please see tables annexed to this report.

Under an arrangement made by the Board with the Committee on Water for the Town of Saugus, we have put in 25 services, in addition to the above, for citizens of East Saugus, the whole expense of which is paid by those ordering the work done, and without any charge to the city.

In the Spring of 1878, a contract was made by the City Government with the Town of Saugus to supply the village of East Saugus with water, for which purpose the Town of Saugus has laid 5,810 feet of pipe and set twelve hydrants, eleven gates and one blow-off. Early in October, the pipes were filled at the request of their contractor, and the water shut off again. On the tenth of October the water was formally let on to their works, and has since continued in constant use.

The Board, under authority conferred by the City Council, also made an arrangement to supply a small neighborhood in the Town of Swampscott, they furnishing their own pipe and services. Accordingly they laid 1,778 feet of 2½ inch and 2 inch pipe as mains, and 9 services. Early in May the same was connected with our main at the head of Ocean street and the water let on.

The total length of distributing pipes connected with the works January 1, 1879, is as follows:

| | | |
|---|---|---|
| Lynn | 51 Miles, | 4,978 feet. |
| Saugus | 1 " | 530 " |
| Swampscott | | 1,778 " |
| Total | 53 Miles | 2,006 feet. |

All of which is believed to be in good condition. All hydrants and gates have been examined, and repaired where necessary, and all are in good condition and ready for use.

Annexed please find the usual tables showing the work done by the pumping engine, the cost of pumping, consumption of water, height of water in ponds, rainfall, etc.

All of which is respectfully submitted,

DANIEL WALDEN,
*Superintendent.*

# TABLE I

## [illegible] RECORD FOR THE YEAR ENDING DECEMBER 31, [illegible]

| Month. | D. | H. | M. | H. | M. | [illegible] | Rev. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | p. ct. | Gallons. | Galls. | Galls. | Feet. | Lbs. | Lbs. | Lbs. | Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 11,200 | 4,910 | 11.91 | [illegible] | 628.41 | 1,011.51 | 165.74 | 90,418,353 | 102,651,864 | 111,076,125 | 129,120,308 |
| February | | [illegible] | [illegible] | [illegible] | [illegible] | 113,111 | [illegible] | [illegible] | 31,100 | [illegible] | 12,300 | [illegible] | 12.11 | 26,758,918 | 632.60 | 1,017.96 | 165.66 | 90,901,064 | 103,887,900 | 111,890,657 | 127,713,816 |
| March | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 2,100 | [illegible] | 7,290 | 11.91 | 38,233,022 | 625.19 | 1,036.12 | 165.73 | 89,941,565 | 102,131,785 | 113,196,306 | 128,897,148 |
| April | 16 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 1,800 | [illegible] | 7,112 | 11.07 | 31,284,635 | 616.44 | 1,025.78 | 166.41 | 89,125,002 | 103,192,143 | 112,655,065 | 131,104,303 |
| May | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 6,085 | 11.80 | 32,009,079 | 622.04 | 1,032.33 | 165.96 | 89,631,773 | 101,631,421 | 113,950,002 | 129,198,087 |
| June | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 10,100 | [illegible] | 2,000 | [illegible] | 7,785 | 12.67 | 38,522,575 | 626.80 | 1,039.82 | 165.87 | 90,280,230 | 103,376,897 | 113,323,823 | 129,774,267 |
| July | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 11,800 | [illegible] | 3,300 | [illegible] | 8,800 | 12.59 | [illegible] | 631.19 | 1,015.74 | 165.60 | 90,797,347 | 103,885,253 | 115,880,172 | 132,532,851 |
| August | 13 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 11,500 | [illegible] | 2,100 | 66,150 | 9,140 | 13.82 | 40,153,367 | 611.54 | 1,011.06 | 165.83 | 88,052,047 | 102,168,793 | 111,651,342 | 128,855,220 |
| September | 13 | [illegible] | [illegible] | [illegible] | 10 | [illegible] | [illegible] | 10,000 | 42,000 | 2,700 | [illegible] | 9,010 | 13.72 | 40,278,010 | 611.20 | 1,014.39 | 165.97 | 88,077,728 | 102,080,941 | 110,348,333 | 127,890,704 |
| October | 11 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 9,100 | [illegible] | 2,100 | [illegible] | 6,600 | 11.90 | 35,289,063 | 611.05 | 1,063.05 | 165.97 | 92,379,035 | 104,903,241 | 116,775,411 | 132,082,021 |
| November | 11 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 10,100 | 13,800 | 1,800 | [illegible] | 6,110 | 11.02 | 35,580,681 | 628.80 | 1,059.77 | 165.90 | 92,031,150 | 103,390,531 | 116,907,278 | 131,191,347 |
| December | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 8,200 | 36,400 | 1,500 | 46,100 | 5,290 | 11.45 | 29,050,826 | 630.36 | 1,016.39 | 166.00 | 90,857,381 | 102,600,631 | 115,089,376 | 129,953,314 |
| Tot. & av. | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 667,650 | 83,532 | 12.51 | 117,825,120 | 624.31 | 1,035.66 | 165.89 | 90,137,211 | 103,027,118 | 113,794,101 | 130,022,798 |

## COST OF PUMPING.

| | | |
|---|---|---|
| 667,650 lbs. of coal, average price per net ton, $\$4.59\frac{1}{2}$ | | $1,580 68 |
| 44,650 lbs. of coal for heating, average price per net ton, $\$4.22\frac{1}{4}$ | | 96 26 |
| 10 cords of wood, $4.50 | | 45 50 |
| Lighting | | 27 40 |
| Oil, waste, packing, etc. | | 69 87 |
| Sundries | | 22 31 |
| Wages of Engineer and Fireman | | 1,960 00 |
| | | $3,752 02 |
| Cost of raising one million gallons into the reservoir | $\$8\ 97\frac{89}{100}$ | |
| Cost of raising one million gallons one foot high | $5\frac{41}{100}$ | |

## TABLE II.

### SHOWING THE CONSUMPTION OF WATER FOR THE YEAR ENDING DECEMBER 31, 1878.

| | Water drawn from Reservoir. | Average consumption per day. | Average daily increase. | Average daily decrease. | Average to each consumer. | Average to each inhabitant. |
|---|---|---|---|---|---|---|
| Month. | Gallons. | Gallons. | Gallons. | Gallons. | Galls. | Galls. |
| January .... | 29,861,338 | 963,269 | 13,349 | | 46.6 | 29.2 |
| February ... | 27,365,848 | 977,387 | 14,118 | | 47.3 | 29.6 |
| March...... | 33,005,465 | 1,064,821 | 87,434 | | 51.5 | 32.3 |
| April ....... | 31,193,932 | 1,039,798 | | 25,023 | 50.3 | 31.5 |
| May........ | 33,018,594 | 1,065,116 | 25,318 | | 51.5 | 32.3 |
| June ....... | 38,427,325 | 1,280,911 | 215,795 | | 62.0 | 38.8 |
| July........ | 46,894,203 | 1,512,716 | 231,805 | | 73.2 | 45.8 |
| August ..... | 39,336,741 | 1,268,927 | | 243,789 | 61.4 | 38.4 |
| September.. | 38,769,130 | 1,292,304 | 23,377 | | 62.5 | 39.1 |
| October .... | 38,161,656 | 1,231,021 | | 61,283 | 59.6 | 27.3 |
| November .. | 30,210,179 | 1,007,006 | | 224,015 | 48.7 | 30.5 |
| December .. | 31,433,885 | 1,013,996 | 6,996 | | 49.0 | 30.7 |
| To. and av. | 417,678,296 | 1,144,324 | 42,513 | | 55.4 | 34.6 |

Average daily increase over 1877, 3.86 per cent.

# TABLE III.

STATEMENT SHOWING THE AMOUNT OF RAINFALL ON THE WATERSHED OF BREED'S AND BIRCH PONDS, AMOUNT OF WATER CONSUMED, AMOUNT WASTED, AMOUNT RECEIVED INTO THE PONDS, AND PERCENTAGE OF RAINFALL AVAILABLE FOR USE, FROM 1874 TO 1878 INCLUSIVE.

| Date. | Rainfall. | Amount of rainfall on water-shed. | Amount of water drawn from the ponds for consumption. | Amount of water wasted from the ponds. | Total amount consumed and wasted. | Increase in ponds during the year. | Decrease in ponds during the year. | Total amount of rainfall received into the ponds. | Daily average. | Percentage of rainfall received into the ponds. |
|---|---|---|---|---|---|---|---|---|---|---|
| Year. | Inches. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | per ct. |
| 1874 | 34.917 | 837.154.949 | 485.189.801 | 21.200.000 | 506,389,801 |  | 47,545,394 | 458,844.407 | 1,284,505 | 54.81 |
| 1875 | 41.847 | 1.003.305.644 | 471.387.757 | 11.609.267 | 482.997.024 | 60.281,293 |  | 543,278.317 | 1.488.433 | 54.24 |
| 1876 | 45.05 | 1 080.099.392 | 395.084.629 | 20,500,000 | 415,584,629 | 74.452.111 |  | 490.036.740 | 1,342,566 | 45.37 |
| 1877 | 45.65 | 1.094.484.734 | 402.161.193 | 131.271.511 | 533,438,704 | 60.806.704 |  | 594.285.408 | 1,628,179 | 54.29 |
| 1878 | 57.36 | 1.379,911,034 | 417,678.296 | 205.081,247 | 622,759,543 | 64,712,199 |  | 687,471,742 | 1,883,484 | 49.82 |

## TABLE IV.

### SHOWING THE DEPTH OF WATER IN THE PONDS FOR EACH WEEK DURING THE YEAR 1878.

| Date. | Breed's Pond. | | Birch Pond. | | Date. | Breed's Pond. | | Birch Pond. | | Date. | Breed's Pond. | | Birch Pond. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ft. | In. | Ft. | In. | | Ft. | In. | Ft. | In. | | Ft. | In. | Ft. | In. |
| Jan. 1 | 14 | 3½ | 12 | 10½ | May 18 | 17 | 10½ | 14 | 5½ | Oct. 5 | 12 | 1 | 12 | 2 |
| 5 | 14 | 4 | 12 | 8 | 25 | 17 | 9½ | 14 | 4 | 12 | 11 | 8 | 12 | 2½ |
| 12 | 15 | 3½ | 13 | 0½ | June 1 | 17 | 6 | 14 | 2 | 19 | 11 | 7 | 12 | 4 |
| 19 | 16 | 3 | 13 | 3 | 8 | 17 | 6 | 14 | 0 | 26 | 11 | 3 | 12 | 5 |
| 26 | 16 | 11½ | 13 | 6 | 15 | 17 | 2 | 13 | 9½ | Nov. 2 | 11 | 0 | 12 | 5½ |
| Feb. 2 | 16 | 11 | 13 | 7½ | 22 | 16 | 10 | 13 | 7 | 9 | 10 | 8 | 12 | 5 |
| 9 | 16 | 11 | 13 | 7 | 29 | 16 | 7 | 13 | 4 | 16 | 10 | 1 | 12 | 5 |
| 16 | 16 | 11½ | 13 | 6½ | July 6 | 16 | 4½ | 12 | 10½ | 23 | 11 | 8 | 13 | 6 |
| 23 | 17 | 3 | 13 | 11 | 13 | 16 | 0 | 12 | 5½ | 30 | 13 | 2 | 13 | 6 |
| March 2 | 17 | 0¼ | 13 | 7½ | 20 | 15 | 7 | 12 | 0½ | Dec. 7 | 14 | 6 | 13 | 5 |
| 9 | 17 | 0 | 13 | 7 | 27 | 15 | 4 | 11 | 9½ | 14 | 16 | 0½ | 13 | 6 |
| 16 | 17 | 0½ | 13 | 7½ | Aug. 3 | 14 | 11 | 11 | 10 | 21 | 16 | 9 | 13 | 6 |
| 23 | 17 | 0 | 13 | 7 | 10 | 15 | 8½ | 12 | 5 | 28 | 17 | 4 | 13 | 5 |
| 30 | 17 | 3 | 13 | 8 | 17 | 15 | 7½ | 12 | 7½ | 31 | 17 | 4½ | 13 | 4½ |
| April 6 | 17 | 3 | 13 | 8 | 24 | 15 | 3 | 12 | 7 | | | | | |
| 13 | 17 | 7½ | 13 | 11 | 31 | 14 | 10½ | 12 | 6 | | | | | |
| 20 | 17 | 9½ | 14 | 0 | Sept. 7 | 14 | 4 | 12 | 6 | | | | | |
| 27 | 17 | 11 | 14 | 2 | 14 | 13 | 10½ | 12 | 6 | | | | | |
| May 4 | 18 | 2½ | 14 | 7½ | 21 | 13 | 4 | 12 | 5 | | | | | |
| 11 | 18 | 0 | 14 | 6 | 28 | 12 | 8½ | 12 | 3 | | | | | |

# DIAGRAM,

*Showing the amount of water drawn from the Reservoir,*

# TABLE V.

## SHOWING THE RAINFALL AT THE PUMPING STATION FOR THE YEAR 1878.

| Day of the Month. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1...... | .... | 1.42 | .... | .... | .... | .... | .... | .04 | .01 | .... | .... | .... |
| 2...... | .17 | .... | .44 | .... | .... | .01 | .... | .36 | .90 | .... | .... | .88 |
| 3...... | .... | .... | .06 | .... | .... | .... | .... | .... | .01 | .... | .... | .04 |
| 4...... | .85 | .... | .... | .18 | .... | .... | .... | .45 | .28 | .... | .... | .02 |
| 5...... | .... | .... | .... | .13 | .... | .... | .... | .... | .... | .... | .... | .... |
| 6...... | .... | .... | .... | .22 | .... | .... | .... | 2.60 | .... | .... | .... | .... |
| 7...... | .... | .... | .... | .03 | .... | .... | .... | .05 | .09 | .02 | .01 | .... |
| 8...... | .... | .28 | .... | .... | .... | .52 | .... | .98 | .... | .... | .... | .... |
| 9...... | .... | .... | .... | .... | .05 | .01 | .23 | 2.91 | .... | .37 | .... | .90 |
| 10...... | 1.87 | .52 | .... | .... | .... | .09 | .64 | .... | .... | .... | .... | 1.22 |
| 11...... | .09 | .... | .02 | 1.30 | .... | .02 | .21 | .15 | .13 | .... | .... | .... |
| 12...... | .... | .... | 2.83 | .15 | .... | .13 | .14 | .... | .25 | 2.42 | .17 | .... |
| 13...... | .52 | .... | .06 | .04 | .04 | .... | .... | .... | .01 | .... | .... | .... |
| 14...... | .25 | .... | .04 | .... | .... | .... | .01 | .... | .... | .... | .... | .06 |
| 15...... | .... | .... | .... | .... | .02 | .... | .... | .... | .... | .... | .... | .14 |
| 16...... | .... | .... | .... | .... | .... | .... | .... | .20 | .... | .... | .... | .... |
| 17...... | .... | .35 | 3.44 | .... | .... | .26 | .06 | .... | .... | .... | 1.13 | .... |
| 18...... | .... | .... | .08 | .... | .... | .... | .... | .08 | .... | .02 | 1.70 | .... |
| 19...... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 20...... | .73 | .... | .... | .... | .31 | .... | .... | .... | .... | .... | .22 | .... |
| 21...... | .01 | .27 | .... | .... | .... | .... | .81 | .03 | .... | .... | .07 | .98 |
| 22...... | .14 | 1.97 | .... | .40 | .02 | 1.10 | .08 | .10 | .... | .... | 1.55 | .... |
| 23...... | .... | .... | .... | .13 | .... | .... | .... | .... | .... | 1.45 | .... | .... |
| 24...... | .... | .... | .05 | .... | .... | .21 | .... | .24 | .... | .... | .... | .... |
| 25...... | .23 | .... | .... | .43 | .... | .... | .... | .26 | .... | .... | .03 | .... |
| 26...... | .47 | .... | .... | .31 | .16 | .... | .... | .... | .30 | .... | .... | .... |
| 27...... | .27 | .... | .... | .75 | .... | .... | .05 | .... | .... | .... | 1.29 | .... |
| 28...... | .07 | .... | .29 | .56 | .... | .... | .01 | .... | .... | .... | .02 | .... |
| 29...... | .... | .... | .... | 1.53 | .... | .... | .40 | .... | .... | .... | .... | .02 |
| 30...... | .... | .... | .... | .04 | .27 | .... | .97 | .... | .... | .65 | .... | .01 |
| 31...... | .58 | .... | .... | .... | .11 | .... | .... | .... | .... | .03 | .... | .... |
| Totals | 6.25 | 4.81 | 7.31 | 6.20 | .98 | 2.35 | 3.61 | 8.45 | 1.98 | 4.96 | 6.19 | 4.27 |

Total rainfall for the year, 57.36 inches.

## TABLE VI.

### SHOWING THE AMOUNT AND SIZE OF PIPE LAID IN THE YEAR 1878.

| Name of Street. | | | Size of Pipe. | | | | |
|---|---|---|---|---|---|---|---|
| Street. | From. | To. | 8 | 6 | 4 | 1½ | 1¼ |
| [illegible] | Charles | B. R. B & L. R. R. | | 375 | 42 | | |
| Porter | Essex | Ingalls | | | 680 | | |
| Stephens | Fayette | Autumn | | | 744 | | |
| Moulton | Boston | Winter | | | 868 | | |
| Linden | Cottage | Sumner | | | 1,346 | | |
| Sumner | [illegible] Mill | Boston | | 2,818 | 8 | | |
| Harbor | Pleasant | Shepard | | 1,666 | 11 | | |
| Shepard | End of pipe | Harbor | | 278 | | | |
| Blossom | End of pipe | Harbor | | | 18 | | |
| Western Ave. | Chestnut | Chatham | 1,768 | 47 | | | |
| Sheridan | End of pipe | Adams | | | 408 | | |
| | [illegible] | | | | | | |
| [illegible] | [illegible] | [illegible] | | | | [illegible] | |
| [illegible] | [illegible] | [illegible] | | | | 200 | |
| [illegible] | [illegible] | [illegible] | | | | | [illegible] |
| [illegible] | [illegible] | [illegible] | | | | 128 | |
| [illegible] | Essex | [illegible] | | | | | 1 |
| [illegible] | [illegible] | [illegible] | | | | 140 | |
| M[illegible] | [illegible] | [illegible] | | | | 135 | |
| | | | 1,768 | 5,152 | 4,004 | 727 | [illegible] |

Total extension for 1878 .......... 2 miles, 1,478 feet
Previously .......... 40 " 3,200 "
Total amount of pipe laid to January 1, 1879 .......... 42 " [illegible] "

# TABLE VII.

## SHOWING THE NUMBER AND LOCATION OF HYDRANTS SET IN 1878.

| Street. | Location. | Number. |
|---|---|---|
| Porter | 310 feet N. from Essex Street | 1 |
| Stephens | 275 feet E. from Fayette Street | 1 |
| Moulton | 360 feet N. from Boston Street | 1 |
| Linden | 400 feet W. from Cottage Street | 1 |
| Linden | 400 feet N. from Summer Street | 1 |
| Summer | 550 feet S. E. from Boston Street | 1 |
| Summer | 1,150 feet S. E. from Boston Street | 1 |
| Summer | 105 feet N. W. from Saugus Branch Railroad | 1 |
| Summer | Corner of Ashland Street | 1 |
| Shepard | Corner of Harbor Street | 1 |
| Harbor | 510 feet W. from Pleasant Street | 1 |
| Western Ave. | 375 feet E. from Chestnut Street | 1 |
| Western Ave. | Corner of Cross Street | 1 |
| Western Ave. | 450 feet W. from Chatham Street | 1 |
| Sheridan | 255 feet S. from Adams Street | 1 |

| | |
|---|---|
| Total number of hydrants set in 1878 | 15 |
| Previously set | 366 |
| Total number of hydrants set to January 1, 1879 | 381 |

## TABLE VIII.

### SHOWING NUMBER AND LOCATION OF GATES SET IN 1878.

| Street. | Location. | Size in inches. |
|---|---|---|
| Porter | 12 feet E. from the W. line of Porter Street, on the line of the N. line of Essex Street | 4 |
| Porter | 16 feet E. from the W. line of Porter Street, 1 foot S. from the S. line of Ingalls Street | 4 |
| Stephens | 32 feet N. from the S. line of Stephens Street, 15 feet 8 in. W. from the E. line of Fayette Street | 4 |
| Commercial | 14 ft. W. from the E. line of Commercial Street, (blow off), 36 ft. 6 in. from the N. rail of B. R. B. & L. R. R. | 4 |
| Moulton | 16 feet W. from the E. line of Moulton Street, 6 in. N. from the S. line of Winter Street | 4 |
| Moulton | 16 feet W. from the E. line of Moulton Street, on the line of the N. line of Boston Street | 4 |
| Linden | 16 feet 4 inches N. from the S. line of Linden Street, 10 inches W. from the W. line of Cottage Street | 4 |
| Linden | 21 feet W. from the E. line of Linden Street, on the line of the N. line of Summer Street | 4 |
| Summer | 45 feet 6 in. E. from the W. line of Summer Street, 71 feet S. from the N. line of Boston Street | 6 |
| Summer | 8 feet 6 in. W. from the E. line of Summer Street, 101 feet N. from the N. line of bridge at Butman's Mill | 6 |
| Summer | 11 feet 6 in. W. from the E. line of Summer Street, 24 feet N. from the hydrant near Butman's Mill | 6 |
| Summer | 6 feet 6 in. W. from the E. line of Summer Street, 94 feet N. from the N. line of bridge at mill, (blow off) | 4 |
| [illegible] | 14 feet 6 inches S. from the N. line of Harbor Street, 1 foot 6 in. E. from the E. line of Shepard Street | 6 |
| [illegible] | [illegible] feet S. from the N. line of Harbor Street, on the line of the W. line of Pleasant Street | 6 |
| [illegible] | [illegible] feet 6 in. S. from the N. line of Harbor Street, 20 ft. W. from the W. line of bridge at the creek, (blow off) | 4 |
| [illegible] | [illegible] feet 6 in. E. from the W. line of Blossom Street, [illegible] foot N. from the N. line of Harbor Street | 4 |
| [illegible] | [illegible] feet 4 in. N. from the S. line of Boston Street, 25 feet E. from the E. line of Saugus bridge | 8 |
| [illegible] | [illegible] feet 8 in. S. from the N. line of Western Avenue, [illegible] feet W. from the W. line of Chatham Street | [illegible] |
| [illegible] | [illegible] feet S. from the N. line of Western Avenue, on the line of the E. line of Chestnut Street | [illegible] |
| [illegible] | [illegible] N. from the S. line of Hanover Street, [illegible] W. from the W. line of Johnson Street | [illegible] |
| [illegible] | [illegible] N. from the S. line of Atkins Court, on [illegible] of the W. line of Ocean Street | [illegible] |
| [illegible] | [illegible] E. from the W. line of Pevear's Court, [illegible] of the S. line of Hanover Street | [illegible] |
| [illegible] | [illegible] W. from the E. line of Mill Court, on the line [illegible] N. line of Suffolk Street | [illegible] |
| [illegible] | [illegible] W. from the E. line of Libby Court, on [illegible] N. line of Essex Street | [illegible] |

[illegible] 24. Number of gates previously set, 333.

[illegible] January 1, 1879, 357.

### SHOWING THE NUMBER AND SIZE OF SERVICES PUT IN, IN 1878.

| Month. | Size of Pipe. | | | | | | | | | | Total. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 inch. | | 1 1-2 inch. | | 1 1-4 inch. | | 1 inch. | | 3-4 inch. | | | |
| | No. | Length. | No. | Length. | No. | Length. | No. | Length. | No. | Length. | No. | Length. |
| January .... | .... | ........ | .... | ........ | .... | ........ | 1 | 27.10 | 10 | 259.2 | 11 | 287 |
| February .... | .... | ........ | .... | ........ | .... | ........ | .... | ........ | 1 | 31.10 | 1 | 31.10 |
| March ..... | .... | ........ | .... | ........ | .... | ........ | 1 | 46.6 | 4 | 164.1 | 5 | 210.7 |
| April ....... | .... | ........ | .... | ........ | .... | ........ | 2 | 119.11 | 16 | 624 | 18 | 743.11 |
| May ........ | .... | ........ | .... | ........ | .... | ........ | 8 | 608.5 | 20 | 898.7 | 28 | 1,507 |
| June ....... | .... | ........ | .... | ........ | 3 | 431.1 | 4 | 225 | 35 | 1,460.4 | 42 | 2,116.5 |
| July ....... | .... | ........ | .... | ........ | .... | ........ | 1 | 87.4 | 5 | 347.3 | 6 | 334.7 |
| August ..... | .... | ........ | .... | ........ | 1 | 130 | 3 | 198.7 | 28 | 1,046.8 | 32 | 1,375.3 |
| September .. | .... | ........ | .... | ........ | .... | ........ | .... | ........ | 22 | 1,008.8 | 22 | 1,008.8 |
| October .... | .... | ........ | .... | ........ | .... | ........ | 2 | 129.8 | 19 | 718.2 | 21 | 849.10 |
| November .. | 1 | 62.2 | .... | ........ | .... | ........ | 3 | 116.7 | 29 | 1,236 | 33 | 1.414.9 |
| December .. | .... | ........ | 2 | 443.4 | .... | ........ | 2 | 187.7 | 8 | 315.4 | 12 | 946.3 |
| Totals ..... | 1 | 62.2 | 2 | 443.4 | 4 | 561.1 | 27 | 1,747.5 | 197 | 8.110.1 | 231 | 10,826.1 |

| | | | |
|---|---|---|---|
| Amount of service pipe laid in 1878 ............ | 2 miles, | 266 feet. | |
| Amount previously laid ...................... | 29 " | 3,324 " | |
| Total to January 1, 1879..................... | 31 " | 3,590 " | |
| Amount laid in East Saugus in 1878............ | | 1,333 feet. | |

## TABLE X.

### REPAIRS ON PIPES, GATES AND HYDRANTS FOR THE YEAR 1878.

| Month. | Size of Pipe. | | | | | | | | | | | Size of Gate. | | | | | | Hydrants. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 16 | 12 | 10 | 8 | 6 | 4 | 2 | 1½ | 1¼ | 1 | ¾ | 16 | 12 | 10 | 8 | 6 | 4 | |
| January | 1 | | | 2 | 4 | 5 | | | | 1 | 2 | | | | | | | 1 |
| February | | | | | | 1 | | | | | 1 | | | | | | | |
| March | 1 | | 1 | | 6 | | 5 | | | 1 | | | | | | | | 1 |
| April | 2 | | | | | 1 | 1 | | | 1 | 1 | | | | | | | 1 |
| May | | | | | 3 | 2 | | | | | 1 | | | | | | | 1 |
| June | 1 | | | | 3 | 4 | | | | 1 | 1 | | | | 1 | | | 1 |
| July | | | | 1 | 5 | 3 | | | | | | | | | | | | 1 |
| August | 1 | | | 3 | 5 | | | | | | | 1 | 1 | | 3 | 1 | | 7 |
| September | | | | 1 | 1 | 1 | | | | | | | | | | | | |
| October | | | | 2 | 4 | 3 | | | | | | | | | | | | 2 |
| November | 3 | | 1 | | 4 | 1 | | 1 | | | | | | | | | | 2 |
| December | 1 | | 1 | | | 1 | | | | | 1 | | | | | | | 2 |
| Totals | 10 | | 3 | 9 | 35 | 22 | 6 | 1 | | 4 | 7 | 1 | 1 | | 4 | 1 | | 19 |

In Saugus, eight leaks were repaired at the expense of the contractor.

## METEOROLOGICAL RECORD FOR JANUARY, 1878.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.62 | 17°5 | 50 | 29.68 | 29° | 44 | 29.07 | 29° | 43 | 32° | 17°5 | 14°5 | 24°7 | .00 |
| 2 | 29.80 | 26 | 51 | 29.77 | 36 | 62 | 29.77 | 34 | 62 | 38.5 | 6.5 | 32 | 22.5 | .02 |
| 3 | 30.07 | 7 | 41 | 30.31 | 15 | 21 | 30.45 | 14 | 26 | 17 | 5 | 12 | 11 | .00 |
| 4 | 30.41 | 11 | 69 | 30.14 | 32 | 89 | 29 78 | 34.5 | 95 | 42 | 11.5 | 30.5 | 26.7 | .55 |
| 5 | 29.56 | 30 | 70 | 29.74 | 33 | 66 | 29.95 | 23 | 46 | 35.5 | 15 | 20.5 | 25.2 | .00 |
| 6 | 30.12 | 16 | 57 | 30.06 | 22 | 45 | 30.08 | 19 | 31 | 23.5 | 4.5 | 19 | 14 | .00 |
| 7 | 30.18 | 6 | 50 | 30.28 | 15 | 36 | 30.43 | 10 | 44 | 15.5 | 4 | 19.5 | 5.7 | .00 |
| 8 | 30.71 | 2 | 70 | 30.72 | 16 | 46 | 30.69 | 22 | 54 | 26 | 2.5 | 28.5 | 11.7 | .00 |
| 9 | 30.56 | 23.5 | 72 | 30.50 | 31 | 89 | 30.49 | 31 | 67 | 36 | 21 | 15 | 28 5 | .00 |
| 10 | 30.29 | 31 | 84 | 30.05 | 37 | 90 | 29.79 | 41 | 100 | 43 | 32 | 11 | 37.5 | 1.43 |
| 11 | 29.08 | 36 | 95 | 29 08 | 38 | 86 | 29.13 | 36 | 90 | 40 | 35.5 | 4.5 | 37 7 | .02 |
| 12 | 29.76 | 36 | 63 | 29.86 | 41.5 | 62 | 29.99 | 41 | 57 | 45 | 32.5 | 12.5 | 38.7 | .00 |
| 13 | 30.18 | 33.5 | 66 | 30.17 | 41 | 61 | 30.15 | 38 | 64 | 43 | 32 | 11 | 37.5 | .35 |
| 14 | 29.89 | 38.5 | 100 | 29.48 | 43 | 96 | 29.48 | 39 | 90 | 46 | 35 | 11 | 40.5 | .48 |
| 15 | 29.51 | 34.5 | 80 | 29.55 | 39.5 | 48 | 29.62 | 38 | 51 | 41 | 14.5 | 26.5 | 27.7 | .00 |
| 16 | 29.91 | 14.5 | 46 | 30.00 | 17 | 36 | 30.12 | 13 | 36 | 18.5 | 7 | 11.5 | 12.7 | .00 |
| 17 | 30.30 | 7 | 54 | 30.32 | 21 | 42 | 30.29 | 22 | 56 | 29 | 8 | 21 | 18.5 | .00 |
| 18 | 30.35 | 18 | 38 | 30.36 | 31 | 78 | 30.37 | 30 | 73 | 32.5 | 18 | 14.5 | 25.2 | .00 |
| 19 | 30.30 | 28 | 88 | 30.21 | 39 | 73 | 30.17 | 40 | 65 | 43.5 | 28 | 15 5 | 35.7 | .00 |
| 20 | 30.12 | 34.5 | 85 | 30.09 | 46 | 73 | 30.10 | 44 | 80 | 48 | 35 | 13 | 41.5 | .62 |
| 21 | 29.90 | 43 | 92 | 29.82 | 43.5 | 87 | 29.79 | 40.5 | 82 | 47 | 39 | 8 | 43 | .00 |
| 22 | 29.62 | 39 | 91 | 29.60 | 46 | 79 | 29.64 | 42 | 74 | 43 | 37 | 6 | 40 | .16 |
| 23 | 29.55 | 36.5 | 90 | 29.56 | 23 | 40 | 29.76 | 7 | 30 | 38.5 | 3 | 35.5 | 20.7 | .00 |
| 24 | 30.37 | 7 | 30 | 30.39 | 16.5 | 26 | 30.38 | 24 | 68 | 32.5 | 6.5 | 26 | 19.5 | .00 |
| 25 | 30.26 | 32 | 64 | 30.22 | 41 | 61 | 30.21 | 48·5 | 74 | 44 | 32 | 12 | 38 | .35 |
| 26 | 30.04 | 37 | 100 | 29.84 | 41.5 | 95 | 29.85 | 36 | 90 | 44 | 36.5 | 7.5 | 40.2 | .32 |
| 27 | 30.01 | 38 | 72 | 30.02 | 43.5 | 59 | 29.98 | 39.5 | 73 | 43.5 | 37.5 | 6 | 40.5 | .24 |
| 28 | 29.47 | 39 | 95 | 29.43 | 38 | 68 | 29.62 | 25 | 65 | 41 | 8.5 | 32.5 | 24.7 | .07 |
| 29 | 29.99 | 9 | 45 | 30 06 | 17.5 | 43 | 30.13 | 19 | 39 | 53 | 6 | 17 | 14.5 | .00 |
| 30 | 30.40 | 6 | 52 | 30.49 | 16.5 | 34 | 30.50 | 17.5 | 36 | 22 | 7 | 15 | 14.5 | .00 |
| 31 | 30.49 | 21.5 | 72 | 30.42 | 29 5 | 78 | 30.25 | 28 | 94 | 30 | 28 | 2 | 29 | 1.87 |

Monthly range . . . . . . . . . . . . . . . 52

Monthly mean . . . . . . . . . . . . . . . 27.31

Monthly rainfall . . . . . . . . . . . . . . 6.48

## METEOROLOGICAL RECORD FOR FEBRUARY, 1878.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.78 | 30° | 100 | 29.81 | 22° | 94 | 29.91 | 22° | 100 | 29° | 12°5 | 16°5 | 20°7 | .06 |
| 2 | 30.15 | 12.5 | 52 | 30.19 | 17.5 | 52 | 30.21 | 19 | 69 | 25 | 10.5 | 14.5 | 17.7 | .00 |
| 3 | 30.32 | 12 | 61 | 39.29 | 27 | 76 | 30.22 | 21.5 | 66 | 33 | 12 | 21 | 22.5 | .00 |
| 4 | 30.00 | 20 | 70 | 29.91 | 35 | 62 | 29.88 | 28.5 | 72 | 36 | 18.5 | 17.5 | 27.2 | .00 |
| 5 | 29.89 | 21 | 71 | 29.94 | 35 | 70 | 29.98 | 33.5 | 80 | 39 | 22 | 17 | 30.5 | .00 |
| 6 | 30.12 | 24 | 74 | 30.13 | 37 | 55 | 30.13 | 36 | 63 | 40 | 25 | 15 | 32.5 | .00 |
| 7 | 30 10 | 31 | 68 | 30.04 | 45 | 60 | 30.03 | 42.5 | 70 | 48.5 | 31 | 17.5 | 39.7 | .00 |
| 8 | 29.90 | 31.5 | 84 | 29.84 | 47.5 | 66 | 29.70 | 43.5 | 78 | 49 | 33 | 16 | 41 | .56 |
| 9 | 29.47 | 36.5 | 95 | 29.62 | 38.5 | 77 | 29.75 | 40.5 | 77 | 44 | 33.5 | 10.5 | 38.7 | .18 |
| 10 | 29.74 | 34 5 | 95 | 29.52 | 32.5 | 95 | 29.46 | 23.5 | 82 | 34.5 | 23 | 11.5 | 28.7 | .19 |
| 11 | 29.60 | 24 | 86 | 39.64 | 28 | 65 | 29.70 | 21 | 71 | 31.5 | 11.5 | 20 | 21.5 | .00 |
| 12 | 29.91 | 13 | 52 | 29.96 | 26 | 51 | 29.91 | 26 | 75 | 29 | 13.5 | 15.5 | 21.2 | .00 |
| 13 | 29.91 | 26 | 87 | 29.84 | 36 | 59 | 29.86 | 35 | 54 | 41 | 17 | 24 | 29 | .00 |
| 14 | 30.10 | 17.5 | 67 | 30.09 | 30 | 78 | 30.08 | 28.5 | 55 | 33.5 | 13 | 20.5 | 23.2 | .00 |
| 15 | 30.09 | 14 | 64 | 30.08 | 34.5 | 58 | 30.03 | 30 | 67 | 36.5 | 15.5 | 21 | 26 | .00 |
| 16 | 29.99 | 26 | 76 | 29.98 | 37 | 59 | 30.00 | 32 | 69 | 39 | 24 | 15 | 31.5 | 00 |
| 17 | 30.01 | 25 | 87 | 30.00 | 37.5 | 47 | 29.92 | 35 | 71 | 38 | 23 | 15 | 30.5 | .32 |
| 18 | 29.87 | 23 | 80 | 29.94 | 25 | 68 | 29.98 | 22.5 | 53 | 29.5 | 7 | 22.5 | 18.2 | .00 |
| 19 | 30.18 | 10 | 58 | 30.23 | 24 | 59 | 30.21 | 25 | 68 | 28 | 10 | 18 | 19 | .00 |
| 20 | 30.24 | 24 | 54 | 30.22 | 33 | 70 | 30.13 | 35 | 71 | 38 | 25 | 13 | 31.5 | .01 |
| 21 | 30.09 | 33 | 89 | 30.14 | 32 | 89 | 30.19 | 33.5 | 89 | 37 | 32.5 | 4.5 | 34.7 | .23 |
| 22 | 30.28 | 32.5 | 85 | 30.15 | 34 | 90 | 29.95 | 36.5 | 100 | 40.5 | 32.5 | 8 | 36.5 | 4.05 |
| 23 | 29.76 | 35 | 95 | 29.82 | 40 | 82 | 29.81 | 37 | 85 | 43.5 | 35 | 8.5 | 39.2 | .01 |
| 24 | 29.76 | 35.5 | 85 | 29.75 | 44 | 64 | 29.82 | 41 | 66 | 45 | 34 | 11 | 39.5 | .00 |
| 25 | 29.89 | 33.5 | 66 | 29.81 | 37 | 56 | 29.80 | 32.5 | 59 | 38 | 27 | 11 | 32.5 | .00 |
| 26 | 29.80 | 27.5 | 60 | 29.81 | 33.5 | 57 | 29.83 | 36 | 54 | 39 | 27.5 | 11.5 | 33.2 | .00 |
| 27 | 29.90 | 34.5 | 58 | 29.90 | 45 | 45 | 29.87 | 44.5 | 49 | 48.5 | 31 | 17.5 | 39.7 | .00 |
| 28 | 29.93 | 35 | 62 | 29.93 | 48 | 56 | 29.91 | 46.5 | 51 | 49 | 25 | 24 | 37 | .00 |

| | |
|---|---|
| Monthiy range . . . . . . . . . . . . . | 42 |
| Monthly mean . . . . . . . . . . . . . | 30.13 |
| Monthly rainfall . . . . . . . . . . . . | 5.61 |

## METEOROLOGICAL RECORD FOR MARCH, 1878.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.33 | 25° | 74 | 30.51 | 28° | 65 | 30.32 | 28° | 65 | 30° | 25° | 5° | 27°5 | .00 |
| 2 | 30.45 | 30 | 88 | 30.31 | 39.5 | 69 | 30.14 | 40 | 74 | 48.5 | 32 | 16.5 | 40.2 | .36 |
| 3 | 29.57 | 45.5 | 95 | 29.37 | 46 | 92 | 29.29 | 48 | 86 | 49.5 | 39.5 | 10 | 44.5 | .02 |
| 4 | 29.17 | 41 | 87 | 29.31 | 42 | 66 | 29.51 | 32.5 | 46 | 45 | 24 | 21 | 34.5 | .00 |
| 5 | 30.03 | 25 | 62 | 30.15 | 33 | 51 | 30.23 | 37 | 55 | 38.5 | 25.5 | 13 | 32 | .00 |
| 6 | 30.32 | 35 | 85 | 30.30 | 45 | 69 | 30.25 | 42 | 83 | 47 | 36 | 11 | 41.5 | .00 |
| 7 | 30.03 | 41 | 91 | 29.96 | 56.5 | 72 | 29.94 | 51.5 | 75 | 58.5 | 42 | 16.5 | 50.2 | .01 |
| 8 | 30.16 | 45 | 72 | 30.24 | 57 | 49 | 30.28 | 56 | 45 | 59.5 | 39 | 20.5 | 49.2 | .00 |
| 9 | 30·50 | 41 | 66 | 30.52 | 42 | 66 | 30.52 | 39 | 72 | 45 | 37 | 8 | 41 | .00 |
| 10 | 30.30 | 43.5 | 63 | 30.18 | 64.5 | 51 | 30.12 | 63.5 | 57 | 67.5 | 38 | 29.5 | 52.7 | .00 |
| 11 | 30.28 | 38 | 64 | 30.34 | 37 | 63 | 30.34 | 34 | 62 | 39 | 34 | 5 | 36.5 | .01 |
| 12 | 30.37 | 35 | 84 | 30.35 | 37 | 63 | 30.30 | 35 | 80 | 39 | 33.5 | 5.5 | 36.2 | 2.95 |
| 13 | 29.73 | 37 | 100 | 29.60 | 42 | 87 | 29.62 | 39.5 | 86 | 43.5 | 37 | 6.5 | 40.2 | .06 |
| 14 | 29.66 | 39 | 77 | 29.72 | 45.5 | 57 | 29.74 | 44 | 59 | 47 | 33.5 | 13.5 | 40.2 | .04 |
| 15 | 29.91 | 35 | 80 | 29.97 | 46 | 47 | 30.02 | 44 | 52 | 47 | 31 | 16 | 39 | .00 |
| 16 | 29.12 | 34 | 80 | 30.15 | 39 | 72 | 30.11 | 38 | 72 | 41 | 38 | 3 | 39.5 | .00 |
| 17 | 30.08 | 38.5 | 86 | 30.06 | 39.5 | 73 | 29.94 | 39 | 91 | 41 | 34 | 7 | 37.5 | 3.73 |
| 18 | 29.77 | 34 | 95 | 29.76 | 34.5 | 90 | 29.82 | 35.5 | 76 | 38 | 32 | 6 | 35 | .03 |
| 19 | 29.86 | 38 | 72 | 29.79 | 50 | 51 | 29.74 | 46 | 57 | 50 | 37 | 13 | 43.5 | .00 |
| 20 | 29.73 | 38 | 63 | 29.74 | 40 | 52 | 29.78 | 35 | 45 | 41.5 | 22 | 19.5 | 31.7 | .00 |
| 21 | 30.05 | 24 | 54 | 30.11 | 31 | 38 | 38.11 | 32 | 39 | 37 | 23 | 14 | 30 | .00 |
| 22 | 30.19 | 26 | 57 | 30.13 | 34.5 | 49 | 30.07 | 36 | 50 | 38 | 23 | 15 | 30.5 | .00 |
| 23 | 29.85 | 38 | 64 | 29.69 | 53 | 54 | 29.56 | 54 | 55 | 59 | 38.5 | 10.5 | 43.7 | .00 |
| 24 | 29.30 | 44 | 71 | 29.12 | 52.5 | 69 | 29.07 | 42 | 66 | 57 | 13 | 44 | 35 | .05 |
| 25 | 29.40 | 15 | 47 | 29.49 | 25 | 49 | 29.59 | 26 | 63 | 31 | 15 | 16 | 23 | .00 |
| 26 | 29.85 | 31 | 68 | 29.86 | 42 | 50 | 29.87 | 43 | 58 | 45 | 35 | 10 | 40 | .00 |
| 27 | 29.93 | 37.5 | 81 | 29.81 | 46 | 69 | 29.73 | 44.5 | 79 | 47.5 | 38.5 | 9 | 43 | .00 |
| 28 | 29.77 | 44 | 84 | 29.70 | 49 | 74 | 29.66 | 40 | 91 | 53 | 38 | 15 | 45.5 | .33 |
| 29 | 29.74 | 38 | 91 | 29.81 | 43 | 78 | 29.89 | 43 | 67 | 45 | 36 | 9 | 40.5 | .00 |
| 30 | 30.11 | 39 | 56 | 30.10 | 50.5 | 38 | 30.05 | 44 | 52 | 55.5 | 36.5 | 19 | 46 | .00 |
| 31 | 29.92 | 38 | 68 | 29.84 | 43.5 | 63 | 29.78 | 38.5 | 72 | 45 | 37.5 | 7.5 | 41.2 | .00 |

| | |
|---|---|
| Monthly range . . . . . . . . . . . . . | 46.5 |
| Monthly mean . . . . . . . . . . . . . | 39.2 |
| Monthly rainfall . . . . . . . . . . . . | 7.59 |

## METEOROLOGICAL RECORD FOR APRIL, 1878.

| Date. | 8 A. M. |  |  | 1 P. M. |  |  | 6 P. M. |  |  | 24 hours ending 8 A. M. |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.65 | 40° | 82 | 29.66 | 39° | 91 | 29.63 | 38°5 | 82 | 42° | 36°5 | 5°5 | 39°2 | .00 |
| 2 | 29.66 | 39 | 72 | 29.69 | 41 | 83 | 29.72 | 45 | 60 | 46 | 39.5 | 6.5 | 42.7 | .00 |
| 3 | 29.79 | 43 | 62 | 29.80 | 41 | 68 | 29.80 | 43 | 67 | 46.5 | 38.5 | 8 | 42.5 | .00 |
| 4 | 29.72 | 42 | 70 | 29.60 | 44 | 59 | 29.51 | 39 | 86 | 45 | 34.5 | 10.5 | 39.7 | .44 |
| 5 | 29.21 | 37 | 91 | 29.20 | 40 | 82 | 29.20 | 41 | 91 | 42 | 37.5 | 4.5 | 39.7 | .15 |
| 6 | 29.20 | 38.5 | 91 | 29.23 | 43 | 83 | 29.24 | 44.5 | 76 | 47.5 | 37.5 | 10 | 42.5 | .18 |
| 7 | 29.39 | 38.5 | 86 | 29.42 | 43 | 75 | 29.49 | 43 | 75 | 47 | 39 | 8 | 43 | .03 |
| 8 | 29.75 | 45 | 60 | 29.91 | 49.5 | 57 | 30.05 | 44 | 76 | 53 | 41 | 12 | 47 | .00 |
| 9 | 30.32 | 42 | 66 | 30.33 | 45 | 68 | 30.31 | 42 | 75 | 52 | 40 | 12 | 46 | .00 |
| 10 | 30.25 | 42.5 | 83 | 30.21 | 48 | 62 | 30.13 | 48 | 70 | 50.5 | 43.5 | 7 | 47 | .00 |
| 11 | 29.97 | 45.5 | 86 | 29.86 | 49 | 86 | 29.80 | 46.5 | 85 | 51 | 43 | 8 | 47 | 1.42 |
| 12 | 29.39 | 44 | 92 | 29.39 | 48.5 | 74 | 29.41 | 51 | 59 | 51 | 44.5 | 6.5 | 47.7 | .21 |
| 13 | 29.42 | 49 | 57 | 29.43 | 50 | 64 | 29.52 | 53 | 48 | 57 | 44.5 | 12.5 | 50.7 | .05 |
| 14 | 29.70 | 47.5 | 59 | 29.73 | 53.5 | 43 | 29.77 | 52 | 47 | 54 | 40.5 | 13.5 | 47.2 | .00 |
| 15 | 29.90 | 46 | 76 | 29.95 | 57 | 58 | 30.04 | 50 | 64 | 58 | 43 | 15 | 50.5 | .00 |
| 16 | 30.23 | 46 | 69 | 30.25 | 47 | 55 | 30.25 | 44.5 | 72 | 49 | 40 | 9 | 44.5 | .00 |
| 17 | 30.24 | 44 | 83 | 30.27 | 45 | 84 | 30.28 | 45 | 84 | 48.5 | 42 | 6.5 | 45.2 | .00 |
| 18 | 30.31 | 48.5 | 71 | 30.27 | 50 | 71 | 30.25 | 45 | 84 | 56 | 42 | 14 | 49 | .00 |
| 19 | 30.04 | 51 | 59 | 29.93 | 69 | 32 | 29.90 | 65 | 39 | 71.5 | 46 | 25.5 | 58.7 | .00 |
| 20 | 30.01 | 50.5 | 68 | 29.96 | 52 | 65 | 29.86 | 56 | 68 | 62 | 51 | 11 | 56.5 | .01 |
| 21 | 29.58 | 61 | 71 | 29.62 | 66 | 36 | 29.74 | 60 | 44 | 66 | 44 | 22 | 55 | .00 |
| 22 | 30.04 | 51 | 39 | 30.05 | 55 | 44 | 30.04 | 52 | 53 | 60 | 46 | 14 | 53 | .43 |
| 23 | 30.13 | 46 | 88 | 30.18 | 46.5 | 88 | 30.19 | 46 | 92 | 48 | 44 | 4 | 46 | .13 |
| 24 | 30.11 | 44 | 96 | 30.07 | 50 | 86 | 30.13 | 49 | 86 | 59 | 45 | 14 | 52 | .01 |
| 25 | 29.94 | 57.5 | 84 | 29.90 | 68.5 | 76 | 29.89 | 62 | 91 | 69 | 51.5 | 17.5 | 60.2 | .39 |
| 26 | 29.87 | 55 | 100 | 29.90 | 51.5 | 100 | 29.90 | 52 | 93 | 54 | 50 | 4 | 52 | .30 |
| 27 | 30.01 | 54 | 97 | 30.05 | 56 | 93 | 30.05 | 51 | 96 | 58.5 | 49.5 | 9 | 54 | .81 |
| 28 | 29.99 | 49 | 96 | 29.97 | 51 | 93 | 29.90 | 49.5 | 96 | 53.5 | 48 | 5.5 | 50.7 | .87 |
| 29 | 29.84 | 50.5 | 96 | 29.87 | 54 | 87 | 29.90 | 53 | 61 | 55 | 45 | 10 | 50 | 1.30 |
| 30 | 29.93 | 45 | 92 | 29.97 | 49 | 86 | 29.97 | 46 | 92 | 50 | 43.5 | 6.5 | 46.7 | .17 |

| | | | |
|---|---|---|---|
| Monthly range . . . . . . . . . . . . . . | 37 | | |
| Monthly mean . . . . . . . . . . . . . | | 48.21 | |
| Monthly rainfall . . . . . . . . . . . . . | | | 6.90 |

## METEOROLOGICAL RECORD FOR MAY, 1878.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.02 | 44°5 | 88 | 29.99 | 51° | 76 | 29.95 | 47° | 85 | 53° | 45° | 8° | 49° | .01 |
| 2 | 29.91 | 53 | 89 | 29.91 | 58.5 | 73 | 29 88 | 56 | 75 | 65 | 54 | 11 | 59.5 | .00 |
| 3 | 29.83 | 65 | 78 | 29.77 | 78 | 53 | 29.77 | 69.5 | 66 | 79 | 57 | 22 | 68 | .00 |
| 4 | 29.82 | 65 | 73 | 29.81 | 72 | 67 | 29.79 | 66 | 76 | 75 | 60 | 15 | 67.5 | .01 |
| 5 | 29.80 | 63 | 86 | 29.70 | 68.5 | 64 | 29.64 | 60 | 83 | 69 | 48 | 21 | 58.5 | .01 |
| 6 | 29.90 | 54 | 68 | 29.87 | 65 | 35 | 29.87 | 62.5 | 44 | 67 | 46.5 | 20.5 | 56.7 | .00 |
| 7 | 29.95 | 56 | 51 | 29.95 | 58 | 53 | 29.91 | 56 | 57 | 60 | 50 | 10 | 55 | .00 |
| 8 | 29.84 | 58 | 58 | 29.85 | 59 | 67 | 29.87 | 55 | 81 | 64 | 51 | 13 | 57.5 | .00 |
| 9 | 29 85 | 51.5 | 96 | 29.83 | 54.5 | 81 | 29.81 | 52 | 86 | 58 | 51 | 7 | 54.5 | .03 |
| 10 | 29.77 | 58 | 64 | 29.71 | 66 | 55 | 29.71 | 65 | 30 | 68 | 46 | 22 | 57 | .00 |
| 11 | 29.70 | 50 | 44 | 29.67 | 55 | 35 | 29.68 | 53 | 36 | 57 | 41.5 | 15.5 | 49.2 | .00 |
| 12 | 29.86 | 47 | 55 | 29.85 | 52.5 | 39 | 29.88 | 49 | 41 | 53 | 39 | 14 | 46 | .00 |
| 13 | 29.93 | 45.5 | 57 | 29.91 | 51.5 | 38 | 29.91 | 51.5 | 38 | 54.5 | 42 | 12.5 | 48.2 | .00 |
| 14 | 30.03 | 46.5 | 51 | 30.05 | 54 | 43 | 30.07 | 48.5 | 62 | 55 | 42 | 13 | 48.5 | .00 |
| 15 | 30.08 | 47.5 | 66 | 30.07 | 48 | 62 | 29.99 | 46.5 | 54 | 51 | 43 | 8 | 47 | .02 |
| 16 | 29.92 | 45.5 | 69 | 29.95 | 50 | 58 | 29.95 | 52.5 | 57 | 54 | 42.5 | 11.5 | 48.2 | .00 |
| 17 | 30.05 | 50 | 71 | 30.07 | 54 | 61 | 30.06 | 55.5 | 56 | 60 | 50 | 10 | 55 | .00 |
| 18 | 30.10 | 60 | 44 | 30.13 | 63 | 40 | 30.14 | 61 | 40 | 65 | 47 | 18 | 56 | .00 |
| 19 | 30.27 | 58 | 58 | 30.32 | 56 | 51 | 30.33 | 51.5 | 76 | 60 | 46 | 14 | 53 | .00 |
| 20 | 30.30 | 51.5 | 83 | 30.30 | 54.5 | 74 | 30.23 | 52 | 76 | 57 | 48 | 9 | 52.5 | .06 |
| 21 | 30.03 | 50 | 86 | 29.97 | 54 | 80 | 29.93 | 57 | 78 | 59.5 | 50 | 9.5 | 54.7 | .02 |
| 22 | 29.90 | 53 | 57 | 29.90 | 58 | 40 | 29.95 | 55.5 | 34 | 60 | 46.5 | 13.5 | 53.2 | .00 |
| 23 | 29.94 | 53 | 61 | 29.98 | 57 | 66 | 30.03 | 58.5 | 61 | 61 | 49 | 12 | 55 | .00 |
| 24 | 30.08 | 53 | 66 | 30.05 | 52.5 | 70 | 29.95 | 52 | 80 | 58 | 50.5 | 7.5 | 54.2 | .00 |
| 25 | 29.87 | 58 | 76 | 29.79 | 62 | 72 | 29.69 | 62 | 66 | 73.5 | 54 | 19.5 | 63.7 | .00 |
| 26 | 29.65 | 59.5 | 79 | 29.60 | 61 | 88 | 29.55 | 62.5 | 77 | 65 | 52 | 13 | 58.5 | .14 |
| 27 | 29.62 | 64 | 62 | 29.63 | 72.5 | 37 | 39.65 | 71 | 40 | 73 | 54 | 19 | 63.5 | .00 |
| 28 | 29.76 | 62 | 61 | 29.77 | 71.5 | 39 | 29.78 | 68 | 47 | 73 | 55 | 18 | 64 | .00 |
| 29 | 29.86 | 62 | 61 | 29.90 | 71 | 39 | 29.93 | 69 | 42 | 73.5 | 53.5 | 20 | 63.5 | .00 |
| 30 | 30.07 | 57 | 72 | 30.09 | 60 | 77 | 30.09 | 55.5 | 84 | 63 | 52 | 11 | 57.5 | .32 |
| 31 | 30.14 | 52 | 93 | 30.18 | 52.5 | 93 | 30.22 | 53 | 89 | 58 | 50 | 8 | 54 | .09 |

| | |
|---|---|
| Monthly range . . . . . . . . . . . . . | 37.50 |
| Monthly mean . . . . . . . . . . . . . | 57.40 |
| Monthly rainfall . . . . . . . . . . . | .71 |

## METEOROLOGICAL RECORD FOR JULY, 1878.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.12 | 78°5 | 72 | 30.11 | 85° | 61 | 30.07 | 83° | 64 | 88° | 69° | 19° | 78°5 | .00 |
| 2 | 30.07 | 78 | 73 | 30.06 | 88.5 | 53 | 30.04 | 85 | 59 | 89 | 71 | 18 | 80 | .00 |
| 3 | 30 09 | 80 | 68 | 30.10 | 89.5 | 49 | 30.08 | 86.5 | 59 | 90.5 | 71.5 | 19 | 81 | .00 |
| 4 | 30.17 | 74.5 | 72 | 30.16 | 73.5 | 68 | 30.13 | 73.5 | 72 | 77.5 | 69 | 8.5 | 73.2 | .00 |
| 5 | 29.96 | 76 | 66 | 29.91 | 85 | 54 | 29.88 | 83 | 36 | 88 | 59.5 | 28.5 | 73.7 | .00 |
| 6 | 29.99 | 68.5 | 60 | 29.97 | 73.5 | 41 | 29.99 | 68.5 | 63 | 76.5 | 57 | 19.5 | 66.7 | .00 |
| 7 | 30.08 | 64.5 | 78 | 30.04 | 80 | 71 | 29.99 | 80.5 | 54 | 82.5 | 65.5 | 17 | 74 | .00 |
| 8 | 30.00 | 75.5 | 43 | 29.99 | 88.5 | 46 | 29.96 | 87 | 50 | 91.5 | 72.5 | 19 | 82 | .00 |
| 9 | 29.70 | 79 | 71 | 29.95 | 88 | 62 | 29.99 | 75.5 | 83 | 90 | 71 | 19 | 80.5 | .14 |
| 10 | 30.00 | 78 | 80 | 29.95 | 87 | 63 | 29.94 | 73 | 85 | 89 | 65 | 24 | 77 | .70 |
| 11 | 30.16 | 71.5 | 69 | 30.22 | 76 | 60 | 30.20 | 70 | 68 | 76 | 66 | 10 | 71 | .23 |
| 12 | 30.26 | 68 | 74 | 30.23 | 71 | 73 | 30.13 | 70 | 79 | 72.5 | 64 | 8.5 | 68.2 | .08 |
| 13 | 30.04 | 64 | 97 | 30.07 | 71.5 | 73 | 30.04 | 68.5 | 84 | 72.5 | 61 | 11.5 | 66.7 | .01 |
| 14 | 29.98 | 68 | 92 | 29.89 | 81 | 58 | 29.82 | 82 | 55 | 83.5 | 67 | 16.5 | 75.2 | .01 |
| 15 | 29.93 | 68.5 | 74 | 30.01 | 65 | 68 | 30.08 | 63.5 | 75 | 69 | 54 | 15 | 61.5 | .00 |
| 16 | 30.16 | 64 | 78 | 30.15 | 66 | 73 | 30.09 | 65 | 78 | 67 | 61 | 6 | 64 | .00 |
| 17 | 30.07 | 66 | 84 | 29.90 | 75 | 73 | 29.89 | 74 | 81 | 78 | 67 | 11 | 72.5 | .05 |
| 18 | 29.80 | 8.5 | 84 | 29.81 | 90 | 56 | 29.82 | 88 | 55 | 92 | 74 | 18 | 83 | .00 |
| 19 | 29.83 | 78 | 78 | 29.81 | 89 | 56 | 29.82 | 88 | 52 | 90 | 67.5 | 22.5 | 78.7 | .00 |
| 20 | 29.99 | 72 | 71 | 29.99 | 77 | 69 | 29.95 | 69 | 84 | 78 | 64 | 14 | 71 | .00 |
| 21 | 29.80 | 67 | 92 | 29.69 | 72 | 78 | 29.56 | 66.5 | 92 | 75 | 65 | 10 | 70 | .72 |
| 22 | 29.49 | 70 | 71 | 29.94 | 74 | 59 | 29.54 | 72 | 54 | 75 | 60 | 15 | 67.5 | .04 |
| 23 | 29.84 | 64 | 62 | 29.90 | 72 | 58 | 29.93 | 69 | 56 | 77 | 59 | 18 | 68 | .00 |
| 24 | 30.07 | 69 | 65 | 30.05 | 80.5 | 40 | 30.02 | 80 | 47 | 83 | 62 | 21 | 72.5 | .00 |
| 25 | 29.98 | 0 | 64 | 29.90 | 82.5 | 44 | 29.85 | 81 | 52 | 84.5 | 68 | 16.5 | 76.2 | .00 |
| 26 | 29.88 | 72 | 78 | 29.85 | 79 | 70 | 29.80 | 75 | 75 | 81.5 | 69 | 12.5 | 75.2 | .04 |
| 27 | 29.65 | 73 | 88 | 29.71 | 82 | 63 | 29.77 | 80 | 66 | 85 | 64.5 | 20.5 | 74.7 | .02 |
| 28 | 30.03 | 7 | 64 | 30.09 | 77.5 | 49 | 30.09 | 77 5 | 41 | 80 | 61.5 | 18.5 | 70.7 | .00 |
| 29 | 30.18 | 69.5 | 82 | 30.15 | 72.5 | 54 | 30.12 | 70 | 75 | 79.5 | 61 | 18.5 | 70.2 | .29 |
| 30 | 30.11 | 64 | 94 | 30.10 | 61.5 | 97 | 30.04 | 64 | 94 | 65 | 57 | 8 | 61 | 1.35 |
| 31 | 30.02 | 58 | 97 | 30.02 | 62 | 83 | 30.03 | 62 | 80 | 64.5 | 58 | 6.5 | 61.2 | .01 |

Monthly range . . . . . . . . . . . . . 38
Monthly mean . . . . . . . . . . . . . 72.46
Monthly rainfall . . . . . . . . . . . . 3.69

## METEOROLOGICAL RECORD FOR AUGUST. 1878.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.03 | 62°5 | 83 | 29.99 | 63° | 83 | 29.93 | 62°5 | 91 | 65° | 59° | 6° | 62° | .04 |
| 2 | 29.75 | 62.5 | 100 | 29.73 | 69.5 | 82 | 29.07 | 64.5 | 92 | 71 | 61.5 | 9.5 | 66.2 | .24 |
| 3 | 29.73 | 64 | 94 | 29.74 | 71 | 80 | 29.74 | 68 | 58 | 79 | 62.5 | 16.5 | 70.7 | .00 |
| 4 | 29.88 | 68.5 | 87 | 29.90 | 71 | 80 | 29.93 | 67.5 | 82 | 75 | 59.5 | 15.5 | 67.2 | .43 |
| 5 | 29.98 | 67 | 89 | 29.97 | 76 | 77 | 29.94 | 74 | 77 | 78 | 63 | 15 | 70.5 | .00 |
| 6 | 29.90 | 63 | 97 | 29.82 | 67 | 92 | 29.76 | 66 | 100 | 68.5 | 63.5 | 5 | 66. | 1.63 |
| 7 | 29.70 | 68.5 | 89 | 29.70 | 78 | 65 | 29.72 | 67.5 | 76 | 80 | 61 | 19 | 70.5 | .04 |
| 8 | 29.81 | 67.5 | 74 | 29.81 | 76 | 54 | 29.80 | 77 | 61 | 78.5 | 64 | 14.5 | 71.2 | 1.04 |
| 9 | 29.72 | 71 | 84 | 29.65 | 69 | 90 | 29.63 | 65.5 | 100 | 76 | 64 | 12 | 70 | 2.46 |
| 10 | 29.72 | 69.5 | 77 | 29.74 | 77 | 65 | 29.73 | 73 | 76 | 79 | 65 | 14 | 72 | .00 |
| 11 | 29.80 | 69 | 79 | 29.81 | 77 | 67 | 29.79 | 72 | 80 | 80.5 | 62.5 | 18 | 71.5 | 13 |
| 12 | 29.90 | 67 | 72 | 29.91 | 75 | 60 | 29.91 | 70 | 68 | 76 | 61 | 15 | 68.5 | .00 |
| 13 | 29.96 | 68 | 74 | 29.98 | 78 | 62 | 29.95 | 74 | 77 | 79 | 61.5 | 17.5 | 70.2 | .00 |
| 14 | 30.03 | 70 | 77 | 30.04 | 73 | 67 | 30.03 | 71 | 73 | 74 | 61 | 13 | 67.5 | .00 |
| 15 | 30.13 | 65.5 | 94 | 30.19 | 72 | 76 | 30.15 | 66 | 94 | 72.5 | 65.5 | 7 | 69 | .00 |
| 16 | 30.27 | 71 | 85 | 30.25 | 73 | 85 | 30.20 | 70 | 92 | 74.5 | 68 | 6.5 | 71.2 | .18 |
| 17 | 30.12 | 72 | 95 | 30.09 | 77 | 82 | 30.03 | 73 | 88 | 78 | 66.5 | 11.5 | 72.2 | .17 |
| 18 | 29.94 | 69.5 | 90 | 29.88 | 78.5 | 65 | 29.84 | 73 | 74 | 81 | 59.5 | 21.5 | 70.2 | .00 |
| 19 | 29.75 | 67.5 | 72 | 29.70 | 75 | 60 | 29.67 | 72 | 71 | 77 | 63.5 | 13.5 | 70.2 | .00 |
| 20 | 29.61 | 68 | 76 | 29.61 | 75 | 73 | 29.61 | 73 | 73 | 78 | 63.5 | 14.5 | 70.7 | .00 |
| 21 | 29.72 | 70.5 | 51 | 29.77 | 72 | 71 | 29.84 | 70 | 70 | 79 | 62 | 17 | 70.5 | .19 |
| 22 | 30.06 | 63 | 89 | 30.11 | 64 | 75 | 30.11 | 62 | 74 | 65 | 53 | 12 | 59 | .02 |
| 23 | 30.21 | 61 | 83 | 30.23 | 66 | 75 | 30.20 | 65 | 59 | 68 | 51 | 17 | 59.5 | .00 |
| 24 | 30.17 | 62 | 77 | 30.10 | 67 | 79 | 29.99 | 66 | 78 | 71 | 68 | 3 | 69.5 | .20 |
| 25 | 29.70 | 64 | 97 | 29.61 | 68 | 92 | 29.70 | 67 | 76 | 70 | 51 | 19 | 60.5 | .29 |
| 26 | 29.95 | 58.5 | 79 | 29.96 | 66 | 68 | 29.93 | 67 | 74 | 71 | 54 | 17 | 62.5 | .00 |
| 27 | 29.97 | 63.5 | 86 | 29.95 | 70 | 79 | 29.94 | 70 | 79 | 75.5 | 58 | 17.5 | 66.7 | .00 |
| 28 | 29.99 | 65 | 89 | 30.02 | 67 | 84 | 30.02 | 65 | 89 | 69 | 62 | 7 | 65.5 | .00 |
| 29 | 30.09 | 61 | 94 | 30.11 | 67 | 79 | 30.07 | 64 | 88 | 69 | 58 | 11 | 63.5 | .00 |
| 30 | 30.09 | 67 | 84 | 30.12 | 76 | 81 | 30.13 | 70 | 85 | 76 | 60 | 16 | 68 | .00 |
| 31 | 30.24 | 69.5 | 82 | 30.25 | 72 | 76 | 30.22 | 71 | 71 | 73 | 64.5 | 8.5 | 68.7 | .02 |

Monthly range . . . . . . . . . . . . . . 30

Monthly mean . . . . . . . . . . . . . 67.80

Monthly rainfall . . . . . . . . . . . . 7.0[illegible]

## METEOROLOGICAL RECORD FOR SEPTEMBER, 1878.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.10 | 69° | 92 | 30.03 | 81° | 74 | 30.00 | 76°5 | 84 | 82° | 69° | 13° | 75°5 | .00 |
| 2 | 30.00 | 75 | 83 | 29.98 | 83 | 67 | 29.95 | 73.5 | 90 | 83 | 64 | 19 | 73.5 | 1.17 |
| 3 | 30.03 | 65 | 97 | 30.05 | 73 | 81 | 30.06 | 62.5 | 100 | 83.5 | 60.5 | 23 | 72 | .01 |
| 4 | 30.11 | 62.5 | 100 | 30.13 | 63 | 97 | 30.11 | 62 | 100 | 64 | 61 | 3 | 62.5 | .27 |
| 5 | 30.05 | 62.5 | 100 | 30.02 | 67 | 89 | 30.02 | 61 | 100 | 67 | 60.5 | 6.5 | 63.7 | .01 |
| 6 | 30.09 | 62 | 94 | 30.11 | 66.5 | 87 | 30.13 | 63 | 94 | 70 | 57.5 | 12.5 | 63.7 | .01 |
| 7 | 30.37 | 57 | 100 | 30.45 | 60 | 76 | 30.46 | 58.5 | 76 | 62.5 | 57 | 5.5 | 59.7 | .09 |
| 8 | 30 48 | 57.5 | 87 | 30.46 | 61.5 | 66 | 30.41 | 60 | 73 | 65.5 | 48.5 | 17 | 57 | .00 |
| 9 | 30.35 | 57 | 93 | 30.20 | 65 | 83 | 30.30 | 62 | 88 | 65.5 | 58 5 | 7 | 62 | .00 |
| 10 | 30.25 | 63 | 94 | 30.23 | 68 | 79 | 30.18 | 65 | 92 | 69 | 62 | 7 | 65.5 | .00 |
| 11 | 30.19 | 66 | 94 | 30.21 | 69 | 79 | 30.19 | 68 | 89 | 72.5 | 63.5 | 9 | 68 | .20 |
| 12 | 30.13 | 65 | 100 | 30.10 | 70 | 90 | 30.10 | 70 | 90 | 72.5 | 63 | 9.5 | 67.7 | .22 |
| 13 | 30.03 | 67.5 | 100 | 29.94 | 72 | 85 | 29.85 | 74 | 93 | 78 | 62 | 16 | 70 | .02 |
| 14 | 29.94 | 65 | 58 | 29.94 | 69 | 52 | 29.94 | 66.5 | 62 | 71 | 54.5 | 16 5 | 62.7 | .00 |
| 15 | 30.04 | 55.5 | 74 | 30.08 | 63 | 53 | 30.14 | 59.5 | 68 | 65 | 47 | 18 | 56 | .00 |
| 16 | 30.32 | 54 | 74 | 30.35 | 61 | 66 | 30.33 | 57.5 | 75 | 62 | 49 | 13 | 55.5 | .00 |
| 17 | 30.29 | 57.5 | 84 | 30.23 | 68 5 | 67 | 30.18 | 64 | 89 | 70 | 57.5 | 12.5 | 63.7 | .00 |
| 18 | 30.10 | 64 | 83 | 30.05 | 74 5 | 66 | 30.04 | 73 | 76 | 78 | 58 | 20 | 68 | .00 |
| 19 | 30.19 | 62 | 77 | 30.20 | 67 | 57 | 30.16 | 63 | 86 | 68 | 60 | 8 | 64 | .00 |
| 20 | 30.11 | 66 | 92 | 30.04 | 78 | 59 | 29.99 | 72 | 78 | 80 | 64.5 | 15.5 | 72.2 | .00 |
| 21 | 29.94 | 70 | 90 | 29.92 | 79 | 68 | 29.91 | 72 | 80 | 81 5 | 55.5 | 26 | 68.5 | .00 |
| 22 | 30.16 | 58 | 59 | 30.18 | 63 | 41 | 30 25 | 57 | 41 | 64 | 42 | 22 | 53 | .00 |
| 23 | 30.51 | 49 | 50 | 30 52 | 56 | 57 | 30.51 | 54 | 61 | 58 | 45.5 | 12.5 | 51.7 | .00 |
| 24 | 30.44 | 53 | 80 | 30.36 | 60 | 66 | 30.28 | 62 | 74 | 64 | 53 | 11 | 58 5 | .00 |
| 25 | 30.22 | 63.5 | 88 | 30.22 | 70 | 63 | 30.21 | 62 | 79 | 70 | 54.5 | 15.5 | 62.2 | .00 |
| 26 | 30.13 | 63 | 94 | 30.06 | 73 | 76 | 30.04 | 65 | 83 | 73.5 | 47 | 26.5 | 60.2 | .32 |
| 27 | 30.28 | 50 | 62 | 30.29 | 57 | 52 | 30.32 | 53 | 61 | 60.5 | 38.5 | 22 | 49.5 | .00 |
| 28 | 30.46 | 42.5 | 70 | 30.45 | 52 | 60 | 30.34 | 51 | 79 | 56 | 40 | 16 | 48 | .01 |
| 29 | 30.37 | 46.5 | 88 | 30.35 | 58.5 | 56 | 30.30 | 56.5 | 75 | 60 | 45 | 15 | 52.5 | .00 |
| 30 | 30.27 | 54 | 80 | 30.25 | 60.5 | 73 | 30.22 | 57 | 78 | 62 | 49 | 13 | 55.5 | .00 |

| | |
|---|---|
| Monthiy range . . . . . . . . . . . . . . | 45 |
| Monthly mean . . . . . . . . . . . . . | 62.10 |
| Monthly rainfall . . . . . . . . . . . . | 2.33 |

## METEOROLOGICAL RECORD FOR OCTOBER, 1878.

| | 8 A. M. | | | 2 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.21 | 57° | 82 | 30.17 | 64°5 | 73 | 30.10 | 62° | 83 | 66° | 49° | 17° | 57°5 | .00 |
| 2 | 30.00 | 63 | 80 | 29.93 | 71 | 62 | 29.91 | 68 | 79 | 76 | 59 | 17 | 67.5 | .00 |
| 3 | 29.98 | 62 | 66 | 29.99 | 71 | 40 | 29.96 | 64 | 73 | 73 | 52 | 21 | 62.5 | .00 |
| 4 | 30.01 | 59 | 62 | 29.98 | 70 | 36 | 29.96 | 63 | 67 | 73 | 48 | 25 | 60.5 | .00 |
| 5 | 30.03 | 52 | 73 | 30.04 | 62 | 36 | 30.04 | 56 | 81 | 63 | 49 | 14 | 56 | .00 |
| 6 | 30.03 | 50 | 82 | 30.09 | 53.5 | 83 | 30.09 | 51.5 | 83 | 57 | 42 | 15 | 49.5 | .00 |
| 7 | 30.28 | 46.5 | 81 | 30.27 | 57 | 69 | 30.25 | 56 | 78 | 57 | 47 | 10 | 52 | .01 |
| 8 | 30.19 | 54.5 | 89 | 30.15 | 63 | 61 | 30.15 | 60 | 66 | 66 | 48.5 | 17.5 | 57.2 | .00 |
| 9 | 30.08 | 58.5 | 91 | 29.88 | 68 | 79 | 29.67 | 66 | 84 | 69 | 48 | 21 | 58.5 | .67 |
| 10 | 29.81 | 51 | 59 | 29.85 | 57.5 | 42 | 29.96 | 52.5 | 51 | 59 | 42.5 | 16.5 | 50.7 | .00 |
| 11 | 30.13 | 46.5 | 88 | 30.14 | 53 | 61 | 30.13 | 50 | 68 | 54 | 46 | 8 | 50 | .05 |
| 12 | 30.03 | 47 | 100 | 29.90 | 48.5 | 100 | 29.84 | 44 | 100 | 50 | 42.5 | 7.5 | 46.2 | 2.42 |
| 13 | 29.79 | 49.5 | 64 | 29.83 | 58 | 40 | 29.94 | 55.5 | 42 | 62.5 | 45 | 17.5 | 53.7 | .00 |
| 14 | 30.23 | 48.5 | 71 | 30.22 | 65 | 56 | 30.20 | 53.5 | 77 | 54 | 48 | 6 | 51 | .00 |
| 15 | 30.16 | 54 | 93 | 30.08 | 67 | 55 | 30.08 | 60 | 76 | 70 | 54 | 16 | 62 | .00 |
| 16 | 30.13 | 57 | 63 | 30.11 | 67.5 | 74 | 30.09 | 60 | 82 | 70 | 54 | 16 | 62 | .00 |
| 17 | 30.10 | 64 | 88 | 30.07 | 73 | 61 | 30.04 | 65 | 73 | 73 | 56 | 17 | 64.5 | .00 |
| 18 | 29.94 | 61 | 83 | 29.83 | 62 | 80 | 29.74 | 57 | 93 | 63 | 53.5 | 9.5 | 58.2 | .02 |
| 19 | 29.53 | 55 | 65 | 29.53 | 52 | 66 | 29.55 | 47.5 | 66 | 56 | 41.5 | 14.5 | 48.7 | .00 |
| 20 | 29.70 | 43 | 58 | 29.77 | 52 | 35 | 29.91 | 52.5 | 35 | 57 | 44 | 13 | 50.5 | .00 |
| 21 | 30.09 | 50.5 | 59 | 30.09 | 67 | 37 | 30.11 | 64 | 53 | 69 | 46.5 | 22.5 | 57.7 | .00 |
| 22 | 30.19 | 51 | 79 | 30.20 | 59 | 48 | 30.19 | 52 | 89 | 60 | 51 | 9 | 55.5 | .00 |
| 23 | 30.01 | 52 | 86 | 29.75 | 55 | 87 | 29.57 | 56 | 100 | 61 | 52.5 | 8.5 | 56.7 | 1.53 |
| 24 | 29.63 | 54.5 | 62 | 29.75 | 58.5 | 53 | 29.98 | 53 | 61 | 59 | 48 | 11 | 53.5 | .00 |
| 25 | 30.22 | 49 | 63 | 30.25 | 56 | 63 | 30.29 | 52 | 56 | 59 | 48 | 11 | 53.5 | .00 |
| 26 | 30.38 | 51 | 76 | 30.38 | 54 | 80 | 30.34 | 50.5 | 86 | 55 | 48 | 7 | 51.5 | .00 |
| 27 | 30.27 | 51 | 89 | 30.16 | 59 | 73 | 30.10 | 54 | 80 | 60 | 46 | 14 | 53 | .00 |
| 28 | 29.99 | 46 | 69 | 30.02 | 50.5 | 53 | 30.10 | 45.5 | 57 | 51.5 | 33.5 | 18 | 42.5 | .00 |
| 29 | 30.26 | 36 | 73 | 30.25 | 45 | 53 | 30.25 | 45 | 69 | 49 | 36.5 | 12.5 | 42.7 | .00 |
| 30 | 30.15 | 47 | 88 | 29.92 | 49 | 100 | 29.82 | 50 | 100 | 50 | 44 | 6 | 47 | .83 |
| 31 | 29.70 | 45 | 96 | 29.63 | 50 | 89 | 29.62 | 49 | 93 | 52 | 38 | 14 | 45 | .03 |

Monthly range . . . . . . . . . . . . . . 42.5

Monthly mean . . . . . . . . . . . . . . 54.10

Monthly rainfall . . . . . . . . . . . . . 5.56

## METEOROLOGICAL RECORD FOR NOVEMBER, 1878.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.75 | 41° | 74 | 29.83 | 46° | 47 | 29.96 | 41° | 57 | 52° | 38° | 14° | 45° | .00 |
| 2 | 30.10 | 38.5 | 68 | 30.04 | 52.5 | 38 | 30.00 | 50 | 72 | 45.5 | 40 | 5.5 | 42.7 | .00 |
| 3 | 30.11 | 44 | 75 | 30.16 | 49 | 21 | 30.20 | 37 | 51 | 46 | 29 | 17 | 37.5 | .00 |
| 4 | 30.12 | 31 | 68 | 30.00 | 43 | 43 | 30.03 | 33 | 32 | 44 | 24 | 20 | 34 | .00 |
| 5 | 30.06 | 25 | 62 | 30.08 | 35 | 54 | 30.08 | 34 | 58 | 45 | 24 | 21 | 34.5 | .00 |
| 6 | 30.06 | 29.5 | 66 | 29.98 | 37 | 72 | 29.88 | 37 | 63 | 40.5 | 26 | 14.5 | 33.2 | .00 |
| 7 | 29.83 | 28 | 65 | 29.73 | 42 | 42 | 29.77 | 40 | 56 | 42.5 | 28.5 | 14 | 35.5 | .01 |
| 8 | 29.55 | 29.5 | 73 | 29.56 | 36 | 46 | 29.74 | 31 | 58 | 38.5 | 31 | 7.5 | 34.7 | .00 |
| 9 | 29.66 | 34 | 53 | 29.64 | 38.5 | 60 | 29.64 | 38.5 | 60 | 40.5 | 35 | 5.5 | 37.7 | .00 |
| 10 | 29.67 | 36.5 | 59 | 29.72 | 42 | 62 | 29.79 | 38 | 64 | 44.5 | 36.5 | 8 | 40.5 | .00 |
| 11 | 29.83 | 40 | 82 | 29.79 | 54 | 58 | 29.75 | 50 | 64 | 56 | 36.5 | 19.5 | 46.2 | .11 |
| 12 | 29.46 | 50 | 96 | 29.46 | 56.5 | 65 | 29.55 | 55 | 56 | 57 | 38.5 | 18.5 | 47.7 | .00 |
| 13 | 29.69 | 42.5 | 75 | 29.59 | 50 | 62 | 29.73 | 42 | 58 | 51.5 | 31 | 20.5 | 41.2 | .00 |
| 14 | 30.14 | 32 | 69 | 30.22 | 39 | 51 | 30.28 | 36 | 54 | 41 | 27 | 14 | 34 | .00 |
| 15 | 30.50 | 29 | 66 | 30.52 | 40.5 | 56 | 30.52 | 39.5 | 66 | 42 | 29 | 13 | 35.5 | .00 |
| 16 | 30.55 | 30 | 67 | 30.55 | 44 | 75 | 30.51 | 41 | 74 | 45.5 | 32 | 13.5 | 38.7 | .00 |
| 17 | 30.40 | 41.5 | 78 | 30.37 | 42 | 78 | 30.35 | 43 | 92 | 48.5 | 41.5 | 7 | 45 | .97 |
| 18 | 30.23 | 43 | 100 | 30.20 | 43.5 | 00 | 30.00 | 43 | 100 | 44 | 35 | 9 | 39.5 | 1.55 |
| 19 | 29.89 | 36.5 | 90 | 29.90 | 42 | 83 | 29.95 | 43 | 75 | 45 | 37 | 8 | 41 | .00 |
| 20 | 29.89 | 37.5 | 85 | 29.81 | 39 | 100 | 29.79 | 38 | 91 | 41.5 | 37.5 | 4 | 39.5 | .19 |
| 21 | 29.89 | 40.5 | 95 | 29.92 | 49 | 78 | 29.93 | 45 | 84 | 50 | 42 | 8 | 46 | .06 |
| 22 | 29.74 | 44 | 93 | 29.39 | 45.5 | 00 | 29.15 | 49 | 86 | 50.5 | 41.5 | 9 | 46 | 1.32 |
| 23 | 29.02 | 42.5 | 78 | 29.09 | 46 | 76 | 29.25 | 44 | 75 | 49 | 41 | 8 | 45 | .00 |
| 24 | 29.64 | 41.5 | 78 | 29.75 | 46.5 | 66 | 29.89 | 43.5 | 68 | 47.5 | 33 | 14.5 | 40.2 | .00 |
| 25 | 30.04 | 37.5 | 76 | 30.02 | 42 | 75 | 29.92 | 40 | 77 | 45 | 37.5 | 7.5 | 41.2 | .03 |
| 26 | 30.00 | 36.5 | 76 | 30.11 | 38.5 | 64 | 30.20 | 37 | 59 | 41 | 27 | 14 | 34 | .00 |
| 27 | 30.28 | 27 | 88 | 30.23 | 37 | 63 | 30.11 | 39 | 82 | 54 | 28.5 | 25.5 | 41.2 | 1.01 |
| 28 | 29.49 | 49.5 | 89 | 29.44 | 51.5 | 86 | 29.53 | 46.5 | 76 | 52.5 | 36.5 | 16 | 44.5 | .01 |
| 29 | 29.94 | 35.5 | 67 | 30.01 | 44.5 | 50 | 30.05 | 42 | 38 | 46 | 35.5 | 10.5 | 40.7 | .00 |
| 30 | 30.17 | 36 | 71 | 30.21 | 45.5 | 46 | 30.30 | 40.5 | 56 | 47.5 | 28 | 19.5 | 37.7 | .00 |

| | |
|---|---|
| Monthiy range . . . . . . . . . . . . . . . | 33 |
| Monthly mean . . . . . . . . . . . . . . . | 40.02 |
| Monthly rainfall . . . . . . . . . . . . . . . | 5.26 |

## METEOROLOGICAL RECORD FOR DECEMBER, 1878.

| | 8 A. M. | | 1 P. M. | | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.49 | 27 | 76 | 30.50 | 36°5 | 67 | 30.50 | 31°5 | 79 | 42°5 | 28°5 | 14° | 35°5 | .00 |
| 2 | 30.29 | 42 | 83 | 30.00 | 47 | 85 | 29.70 | 51 | 100 | 55 | 42 | 13 | 48.5 | .93 |
| 3 | 29.45 | 45.5 | 84 | 29.53 | 46 | 61 | 29.64 | 45.5 | 65 | 48 | 39 | 9 | 43.5 | .06 |
| 4 | 29.58 | 40.5 | 91 | 29.44 | 43 | 100 | 29.46 | 38 | 91 | 43 | 34 | 9 | 38.5 | .01 |
| 5 | 29.50 | 34 | 80 | 29.55 | 35 | 71 | 29.63 | 32 | 59 | 36 | 26 | 10 | 31 | .00 |
| 6 | 29.66 | 26 | 63 | 29.75 | 32 | 64 | 29.81 | 30 | 67 | 34 | 17.5 | 16.5 | 25.7 | .00 |
| 7 | 29.97 | 18 | 52 | 30.00 | 26.5 | 51 | 30.05 | 24 | 61 | 28.5 | 18.5 | 10 | 23.5 | .00 |
| 8 | 30.24 | 21 | 78 | 30.28 | 27 | 76 | 30.32 | 24.5 | 61 | 30 | 22 | 8 | 26 | .00 |
| 9 | 30.36 | 26 | 57 | 30.29 | 31 | 100 | 30.18 | 34 | 95 | 44 | 27 | 17 | 35.5 | .83 |
| 10 | 29.74 | 44 | 96 | 29.53 | 47.5 | 100 | 29.28 | 49 | 100 | 52 | 42.5 | 9.5 | 47.2 | .98 |
| 11 | 29.10 | 42.5 | 91 | 29.45 | 43.5 | 63 | 29.66 | 39.5 | 64 | 44 | 35.5 | 8.5 | 39.7 | .00 |
| 12 | 30.01 | 36.5 | 67 | 30.35 | 38 | 68 | 30.13 | 34.5 | 62 | 40 | 32 | 8 | 36 | .00 |
| 13 | 30.21 | 32 | 60 | 30.21 | 34 | 52 | 30.23 | 31.5 | 54 | 36 | 24.5 | 11.5 | 30.2 | .00 |
| 14 | 30.22 | 25 | 62 | 30.20 | 31 | 68 | 30.16 | 30.5 | 83 | 36.5 | 26.5 | 10 | 31.5 | .01 |
| 15 | 30.01 | 35 | 73 | 29.90 | 36 | 81 | 29.81 | 34 | 85 | 39 | 24 | 15 | 31.5 | .15 |
| 16 | 29.81 | 24 | 74 | 29.80 | 27 | 58 | 30.00 | 24.5 | 68 | 28.5 | 19.5 | 9 | 24 | .00 |
| 17 | 30.17 | 19.5 | 73 | 30.16 | 26.5 | 70 | 30.13 | 28 | 72 | 31 | 19.5 | 11.5 | 25.2 | .00 |
| 18 | [illegible] | 25 | 81 | 29.90 | 32 | 69 | 30.00 | 31 | 89 | 33.5 | 26 | 7.5 | 29.7 | .00 |
| 19 | [illegible] | 26 | 75 | 30.15 | 27 | 58 | 30.23 | 25 | 50 | 29 | 21 | 8 | 25 | .00 |
| 20 | [illegible] | 23 | 73 | 30.30 | 31.5 | 74 | 30.20 | 30 | 56 | 31 | 20.5 | 10.5 | 25.7 | .03 |
| 21 | [illegible] | 22 | 50 | 30.23 | 29 | 77 | 30.04 | 34 | 95 | 49 | 23 | 26 | 36 | .83 |
| 22 | [illegible] | 39.5 | 73 | 29.30 | 40 | 56 | 29.42 | 34.5 | 66 | 40.5 | 28 | 12.5 | 34.2 | .00 |
| 23 | [illegible] | [illegible] | 82 | 29.70 | 30 | 73 | 29.77 | 23 | 49 | 31 | 19.5 | 11.5 | 25.2 | .00 |
| 24 | [illegible] | [illegible] | 53 | 29.75 | 22 | 31 | 29.74 | 22.5 | 39 | 21.5 | 14.5 | 10 | 19.5 | .00 |
| 25 | [illegible] | [illegible] | 53 | 29.67 | 25 | 69 | 29.69 | 25.5 | 63 | 29.5 | 15.5 | 14 | 22.5 | .00 |
| 26 | [illegible] | 21.5 | 70 | 29.75 | 28.5 | 65 | 29.76 | 26.5 | 70 | 30.5 | 21 | 9.5 | 25.7 | .00 |
| 27 | [illegible] | [illegible] | 72 | 29.61 | 27 | 82 | 29.63 | 26.5 | 82 | 28.5 | 20 | 8.5 | 24.2 | .00 |
| 28 | [illegible] | 22 | [illegible] | [illegible] | 26 | 75 | 30.00 | 24 | 48 | 29 | 13 | 16 | 21 | .00 |
| 29 | [illegible] | [illegible] | 80 | [illegible] | 23 | 51 | 30.16 | 22 | 45 | 27 | 12 | 15 | 19.5 | .01 |
| 30 | [illegible] | [illegible] | [illegible] | [illegible] | 28.5 | 83 | 30.04 | 26.5 | 70 | 31 | 16.5 | 14.5 | 23.7 | .01 |
| 31 | [illegible] | [illegible] | 83 | 30.26 | 31 | 68 | 30.26 | 27 | 64 | 32 | 17 | 15 | 24.5 | .00 |

Monthly range . . . . . . . . . . . . . . 43

Monthly mean . . . . . . . . . . . . . . 30

Monthly rainfall . . . . . . . . . . . . . 3.85

Total rainfall for the year . . . . . . . . . 57.46 inches.

840132

# EIGHTH ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD

OF THE

# CITY OF LYNN,

## FOR THE YEAR ENDING DEC. 31, 1879.

THE NEW YORK
PUBLIC LIBRARY
P 14624
ASTOR, LENOX AND
TILDEN FOUNDATIONS.
1898.

LYNN:
RECORD STEAM BOOK AND JOB PRINT,
No. 77 MUNROE STREET.
1880.

VDLA p.2

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1898.

LYNN:
RECORD STEAM BOOK AND JOB PRINT,
No. 77 MUNROE STREET.
1880.

# Public Water Board.

## OFFICERS FOR 1880.

EDWIN WALDEN, *President*,
FOR ONE YEAR.

THOMAS B. NEWHALL,
FOR TWO YEARS.

DAVID H. SWEETSER,
FOR THREE YEARS.

JAMES N. BUFFUM,
FOR FOUR YEARS.

JAMES PURINTON,
FOR FIVE YEARS.

*Superintendent and Clerk*,
DANIEL WALDEN.

*Water Registrar*,
SIMON J. RONEY.

*Pumping Engineer*,
WILLIAM H. MESSINGER.

*Inspector*,
CHARLES H. CLIFFORD.

*Foreman of Pipe Work*,
EDWIN MAXWELL.

# ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD.

OFFICE OF THE PUBLIC WATER BOARD,
*February* 9, 1880.

The Public Water Board hereby present to the City Council their Eighth Annual Report. We append hereto the Reports of the Superintendent of the Works, and of the Water Registrar, and make the same a part of our own.

We refer to the Report of the Superintendent for a detailed statement of the work the department has been called upon to perform during the past year, and also for information showing the quantity of water consumed, the capacity of our sources of supply, and the condition of the works at the close of the year.

We also invite attention to such other items of information as that officer has thought of importance enough to embody in his Report.

The Registrar's Report furnishes the usual statements showing the receipts and expenditures for the past year; the increase in the number of water takers and in the number and variety of fixtures in use, and the purposes for which water is supplied. Other interesting statements accompany his Report.

The books and accounts of the Registrar have been carefully examined, and the committee having that duty to perform, report them as having been neatly and accurately kept.

We take pleasure in saying that the duties pertaining to the positions of Superintendent and Registrar are faithfully performed. As these places of responsibility are filled by officers of experience, who are faithful and painstaking in the discharge of their duties, no change seems desirable. The Board has, therefore, reappointed the incumbents of last year.

## RECEIPTS.

The total receipts of the department for the year 1879, were $75,734.20; of which amount $1,942.73 was received for extra service pipe, labor, etc., and becomes a credit to the account of construction. Making this deduction, the legitimate receipts will be found to be $73,791.47.

The receipts for the previous year were $67,570.14, showing a gain in receipts for the year 1879, of $6,221.33. This large increase in the receipts, during a year of no more than ordinary business activity, and without the laying of a foot of new pipe for the extension of the works, attests the financial strength of the department, and assures the City Council that no proper expenditures to enlarge the supply of water, or to extend the works, will bring to the tax payers any additional burden.

The success of the Registrar in making his collections, is indeed remarkable, as but $52.50 of the water bills made during the year remained uncollected at the close.

### MAINTENANCE.

The expenses of the department, classed under the head of maintenance, were for the past year, $9,252.38; showing a reduction of $428.07 as compared with the previous year.

When it is remembered that this sum has paid all salaries and office expenses; has supplied all waste and wear so far as new work has been required to replace the old; has provided for the pumping service and paid all salaries connected therewith, and has kept all parts of the works in good working condition, it will be admitted that the affairs of the department are under good management, and that a rigid economy is practiced by the Superintendent and those who work under his direction.

### CONSTRUCTION.

The construction account was increased during the year by the sum of $7,872.41. Of this amount, $4,238.78 was expended in laying new service and small sized iron pipes in courts and places; and

$3,249.87 was paid for labor and material in completing the work at Breed's Pond dam, and for raising the drive-way by which it is approached. No street mains were laid during the year.

## COST OF THE WORKS.

| | | |
|---|---|---|
| Total cost of the Works to Jan. 1, 1879, exclusive of all deficiencies in income to meet expenses of maintenance and interest charges, as previously reported . . . . . . . . . . . . . . . . . . | | $982,294 58 |
| Charges to construction account in 1879 . . . . | | 9,252 38 |
| Total amount of deficiencies in income to meet interest charges and expenses of maintenance . | | 66,670 48 |
| Total gross cost of Works to Jan. 1, 1880 . | | $1.058.217 44 |
| Less amount received from water-takers for extra pipe laid, labor, etc. . . . . . . . . | $33,898 06 | |
| Less premium on bonds placed in 1875 in renewal of loan . . . . . . . . . | 3.000 00 | |
| Less premium on bonds placed in 1878 in renewal of loan . . . . . . . . . | 6,750 00 | |
| Less income in excess of inter't charges and expenses of maintenance, 1879 | 12.749 09 | |
| | | 56.397 15 |
| Total cost of Works to Jan. 1, 1880, including all interest charges . . . . . . . . . | | $1.001.820 29 |
| Water Debt Jan. 1, 1880 . . . . . . . . . . . . | | 921.500 00 |
| Amount paid by taxation for interest on Water Debt and for extension of the Works . . . . . | | $80.320 29 |
| Amount paid by City Treasurer for interest on Water Debt raised by taxation as above . . . | | 66.670 48 |
| Amount paid by City Treasurer for extension of the Works in former years raised by taxation . . . | | $13.649 81 |

**Total amount expended on account of introduction of water, from means raised by taxation, equal to one-third of one per cent. on city valuation for one year.**

## FINANCIAL STANDING.

In our last Report we advised the City Council that the Water Works were in a condition to be made wholly self-sustaining. The income derived from the sale of water for the past year makes certain the statement then submitted. We present the following statement of receipts and expenses of the department for the year: —

| | | |
|---|---|---|
| Receipts from all sources credited to Water Rates | | $73,791 47 |
| Interest on Water Debt . . . . . . | $51,790 00 | |
| Maintenance Account . . . . . . . | 9,252 38 | |
| Total for interest and maintenance . . . . . . . | | 61,042 38 |
| Surplus to account of Water Debt Sinking Fund | | $12,749 09 |

From the foregoing statement it will be seen that the income of the department is not only sufficient to meet the expenses of maintenance and interest on the water debt, but will provide such surplus as a proper contribution to a sinking fund for the extinguishment of the debt will require.

## WATER CONSUMPTION.

The quantity of water supplied through the city works during the year, was 461,756,981 gallons; the daily average being 1,265,088 gallons; and to each consumer 56 gallons. The increase in the consumption as compared with the previous year was 44,078,685 gallons or 10.55 per cent. The increase in the number of services was 6.04 per cent., and in receipts was 9.07 per cent.

The books of the Board of Assessors show that there were 5,802 dwellings in the city on the first day of May last. Of this number 3,397 are connected by service pipes with the city's supply, or 58.51 per cent. of the whole number. The estimated number of families in the city 8,390; of which number 5,117 receive their daily supply of water from the city mains, or 61 per cent. of the estimated number. From these statements it appears that about 40 per cent. of the total population of the city, depend upon wells and cisterns for their supply of water. It should not, however, be inferred that this large per cent. of our population prefer well and cistern water to water furnished by the public supply, for in very many unoccupied streets, lanes, courts and places, water mains have not been laid.

Assuming that the estimated population of the city is substantially correct, we have 35,000 inhabitants. As 40 per cent. of the population are not takers of city water at the present time, it should be assumed, in any calculation to show the future demand for water, that a large proportion of the 14,000 now unsupplied will soon become takers. The city is also rapidly increasing its population and business. New dwellings, factories and business places will be required to furnish accommodations for new industries and a larger population.

The water supply must be large enough to meet these new demands. There is also a larger taking, year by year, by those who are already consumers. The supplies, which in many instances are at first carried only to the kitchen, are extended to chambers, bathrooms and closets. In view of the facts herein presented, together with other information contained in these reports, it will be seen that our limited supply of water must soon be considerably increased. If the City Council fail to take seasonable action upon so important a matter, and refuse to accept the suggestions and opinions of the Water Board, upon the Council must rest the responsibility for any failure in the supply.

EDWIN WALDEN,
THOMAS B. NEWHALL,
DAVID H. SWEETSER,
JAMES N. BUFFUM,
JAMES PURINTON,
*Public Water Board.*

# REPORT OF THE WATER REGISTRAR.

*Hon. Edwin Walden, President of the Public Water Board:*

DEAR SIR: — I have the pleasure to present herewith the Report of the Water Registrar, for the year ending Dec. 31, 1879.

## SERVICES.

The whole number of services January 1, 1879, was 3,892; number of new services put in during the year, 242; discontinued — buildings moved — 7; total number services Jan. 1, 1880, 4,127.

There was shut off during the year, for non-payment of water rates, 27; let on again by payment of rates and fines, 11; let on without payment of the usual fines — property changed owners — 4; still remaining off, 12; number let on that was shut off for non-payment, previous to 1879, 18.

At the beginning of the year there were 76 services remaining shut off — premises vacant; during the year there have been shut off, for the same cause, 94; let on during the year — premises reoccupied — 129; still remaining off, 41.

There have been 17 services put in at East Saugus during the year, making in all, to Jan. 1, 1880, 42.

The places supplied with city water have been examined by the Inspector, and all fixtures not in order have been repaired.

The rate of increase in the number of services for the last [illegible] years, has been as follows: —

| | | | |
|---|---|---|---|
| [illegible] | [illegible] per cent. | In 1877 . . . . | 7.60 per cent. |
| [illegible] | [illegible] | 1878 . . . . | 6.14 " |
| | [illegible] . . | 6.04 per cent. | |

## [illegible] FOR THE YEAR 1879.

| | | |
|---|---|---|
| [illegible] purposes . . | $73,569 93 | |
| [illegible] | | |
| [illegible] . . . | 58 00 | |
| [illegible] . . | 39 54 | |
| [illegible] . . . | 124 00 | |
| | | $73,791 47 |
| [illegible] . . . | | 1,942 73 |
| [illegible] . . . . | | $75,734 20 |

[illegible] paid into the city treasury.

[illegible] water rates, $52.50; on meter [illegible] $2,897.55. Due on account [illegible]

## COMPARATIVE STATEMENT OF REVENUE FOR 1879.

| | | |
|---|---|---|
| Amount collected in 1879 | $73,791 47 | |
| Due and uncollected | 2,897 55 | |
| | | $76,689 02 |
| Deduct amount due at beginning of year | | 2,739 22 |
| Revenue for 1879 | | $73,949 80 |
| Revenue for 1878 | | 67,796 23 |
| Increase of revenue for 1879 | | $6,153 57 |

## STATEMENT OF INTEREST, MAINTENANCE AND REVENUE FOR THE YEAR 1879.

| | | |
|---|---|---|
| Revenue for 1879 | | $73,949 80 |
| Interest for 1879 | $51,790 00 | |
| Maintenance for 1879 | 9,252 38 | |
| | | 61,042 38 |
| Excess of revenue over interest and maintenance | | $12,907 42 |

## EXPENDITURES FOR 1879.

### MAINTENANCE.

| | | |
|---|---|---|
| Salaries and office expenses | $3,259 34 | |
| Repairs on services and miscellaneous | 848 89 | |
| Repairs on mains, hydrants and gates | 502 35 | |
| Labor at reservoir | 27 75 | |
| Labor at Breed's Pond | 101 99 | |
| Repairs on Engines | 27 12 | |
| Repairs on Engine House | 5 30 | |
| Pumping, wages, coal, oil, waste, etc. | 3,883 08 | |
| Stable, hay, grain, etc. | 596 56 | |
| Total maintenance | | $9,252 38 |

### CONSTRUCTION.

| | | |
|---|---|---|
| Services and court mains | $4,238 78 | |
| Mains, hydrants and gates | 99 20 | |
| Meters | 266 81 | |
| Breed's Pond dam | 3,249 87 | |
| Shop and stable | 7 00 | |
| Engine House | 10 75 | |
| Total construction | | $7,872 41 |

Following are tables showing the number of families, dwellings, stores, hotels, etc., etc.; the yearly revenue of the department; the number and kind of fixtures; the class of premises to which meters are attached, etc., etc., all of which is very respectfully submitted.

SIMON J. RONEY,
*Water Registrar.*

## STATEMENT

SHOWING THE NUMBER OF FAMILIES, DWELLINGS, STORES, FACTORIES, ETC., SUPPLIED WITH CITY WATER FOR THE YEAR 1879.

| | |
|---|---|
| Dwellings | 3397 |
| Families | 5117 |
| Boarding Houses | 57 |
| Hotels | 6 |
| Stores | 245 |
| Offices | 75 |
| Restaurants and Saloons | 36 |
| Stables | 192 |
| Stationary Steam Engines and Boilers | 50 |
| Factories | 136 |
| Railroads | 3 |
| Steam Fire Engines and Houses | 4 |
| School Houses | 27 |
| Churches | 13 |
| Public Halls | 15 |
| Printing Offices | 9 |
| Greenhouses | 13 |
| Bakeries | 7 |
| Barber Shops | 12 |
| Planing Mills | 4 |
| Machine and Blacksmith Shops | 12 |
| Markets | 8 |
| Banks | 5 |
| Photographers | 7 |
| Public and Drinking Fountains | 7 |
| Motors | 5 |
| Laundries | 3 |
| Fire Hydrants | 381 |
| Reservoirs | 4 |
| Foundry | 1 |
| Private Fountains | 13 |
| Gas Works | 1 |
| Hand Hose | 1024 |
| City Hall | 1 |
| Almshouse | 1 |
| Post Office | 1 |

## STATEMENT

SHOWING THE YEARLY REVENUE OF THE WATER DEPARTMENT SINCE THE FIRST INTRODUCTION OF WATER INTO THE CITY, IN 1871.

| | | |
|---|---|---|
| From October 1. 1871. to January 1. 1872 . . . . | $8,989 | 00 |
| From January 1. 1872. to Januury 1. 1873 . . . . | 27,568 | 16 |
| From January 1. 1873. to January 1, 1874 . . . . | 47,992 | 61 |
| From January 1. 1874. to January 1. 1875 . . . . | 53,545 | 61 |
| From January 1. 1875. to January 1. 1876 . . . . | 52,553 | 26 |
| From January 1. 1876. to January 1. 1877 . . . . | 60,867 | 12 |
| From January 1. 1877. to January 1, 1878 . . . . | 64,002 | 50 |
| From January 1. 1878. to January 1. 1879 . . . . | 67,570 | 14 |
| From January 1. 1879. to January 1. 1880 . . . . | 73,949 | 80 |
| Total . . . . . . . . . . . . . . . . . | $457,038 | 20 |

# STATEMENT

SHOWING THE NUMBER AND KIND OF FIXTURES CONTAINED WITHIN THE PREMISES OF WATER-TAKERS, TO DECEMBER 31, 1879, AS COMPARED WITH THE PREVIOUS YEAR.

| Kind of Fixtures. | 1878. | 1879. | Increase. | Decrease |
|---|---|---|---|---|
| **Faucets** | 7,307 | 7,897 | 590 | |
| **Bath tubs** | 422 | 423 | 1 | |
| **Water closets — pan** | 1,071 | 1,265 | 194 | |
| **Water closets — hopper** | 71 | 54 | | 17 |
| **Water closets — self-acting hopper** | 2 | 2 | | |
| **Urinals** | — | 41 | | |
| **Hand hose** | 1,038 | 1,024 | | 14 |

# STATEMENT

## EXHIBITING THE CLASS OF PREMISES TO WHICH METERS ARE ATTACHED.

| Name. | Class. | Size. | | | | | |
|---|---|---|---|---|---|---|---|
| | | ½ | ⅝ | ¾ | 1 | 1½ | 2 |
| Eastern Railroad Company | Railroad | | | | 1 | | |
| B. R. B. & L. R. R. Company | “ | | | 1 | 1 | | |
| Lynn & Boston Railway Company | “ | | | | 1 | | |
| P. P. Tapley & Co. | Engine. | | | | 1 | | |
| George H. Newhall | “ | | | | 1 | | |
| Samuel M. Bubier | “ | | | | 1 | | |
| A. B. Martin | “ | | | | 1 | | |
| P. Lennox & Co. | “ | | | | 1 | | |
| L. B. Frazier | “ | | | | 1 | | |
| S. A. Guilford | “ | | | | | 1 | |
| Exchange Engine Co. | “ | | | | 1 | | |
| Swain, Fuller & Co. | “ | | 1 | | | | |
| A. T. Goodwin | “ | | 1 | | | | |
| John T. Moulton | “ | | | | 1 | | |
| Samuel M. Bubier | “ | | | | 1 | | |
| A. M. Woodbridge | “ | | | | 1 | | |
| J. N. Buffum & Co. | “ | | | | 1 | | |
| F. B. Mower & Co. | “ | | | 1 | | | |
| Jerome Ingalls | “ | | | | 1 | | |
| A. T. Goodwin | “ | | | 1 | | | |
| Central Power Co. | “ | | 1 | | | | |
| F. P. & A. K. Drown | “ | | | 1 | | | |
| Keene Bros. | “ | | | | 1 | | |
| W. A. Kelley & Son | “ | | | | 1 | | |
| Bay State Wheel Co. | “ | | | | 1 | | |
| Blaney Bros. | “ | | | | 1 | | |
| D. H. & C. S. Sweetser | “ | | | | 1 | | |
| Peavear & Co. | “ | | | | 1 | | |
| John Ma[illegible] | “ | | | 1 | | | |
| Charles G. Clark & Co. | “ | | | | 1 | | |
| Baldwin & Stillman | “ | | | 1 | | | |
| E. H. Johnson | “ | | | 1 | | | |
| S. F. Crosman & Co. | “ | | | 1 | | | |
| Charles D. P[illegible] | “ | | | | | 1 | |
| Peavear & Co. | “ | | | | 1 | | |
| Geo. E. Marsh & Co. | “ | | | 1 | | | |
| William Coffin | “ | | | 1 | | | |
| Shute & Faulkner | “ | | | | 1 | | |
| Pierce & Ellis | “ | | 1 | | | | |
| W. L. Haskell & Co. | “ | | 1 | | | | |
| J. C. Bennett & P[illegible] | Factory. | | | 1 | | | |
| Carried forward. | | | 5 | 11 | 24 | 2 | 2 |

[STATEMENT EXHIBITING THE CLASS OF PREMISES TO WHICH METERS ARE ATTACHED. — *Continued.*]

| Name. | Class. | Size. | | | | | |
|---|---|---|---|---|---|---|---|
| | | ½ | ⅝ | ¾ | 1 | 1½ | 2 |
| *Brought forward,* | | | 5 | 11 | 24 | 2 | 2 |
| Charles B. Tebbetts | Factory. | | | | 1 | | |
| A. M. Preble | " | | 1 | | | | |
| Moses Norris & Son | " | | | | 1 | | |
| L. S. Johnson | " | | | | 1 | | |
| A. M. Wooldredge | " | | | | 1 | | |
| I. M. Attwill | " | | 1 | | | | |
| Benj. Dupar & Co. | " | | 1 | | | | |
| M. J. Worthly | " | | 1 | | | | |
| Joseph Davis & Co. | " | | | 1 | | | |
| John Dougherty | " | | 1 | | | | |
| Mower Bros. | " | | 1 | | | | |
| B. F. Doak & Co. | " | | | 1 | | | |
| F. W. Breed | " | | | 1 | | | |
| John T. Moulton | " | | 1 | | | | |
| P. P. Sherry | " | | 1 | | | | |
| Charles Buffum | " | | 1 | | | | |
| F. B. Mower | " | | 1 | | | | |
| P. J. Hanley | " | | 1 | | | | |
| Charles B. Clough | " | | 1 | | | | |
| Theodore Attwill | " | | 1 | | | | |
| Proctor & Ingalls | " | | 1 | | | | |
| Spinney & Caldwell | " | | 1 | | | | |
| Kimball Bros. | " | | 1 | | | | |
| John Donallan & Son | " | | | | 1 | | |
| C. H. Bacheller & Co. } | " | | | | | | |
| T. C. Murphy } | " | 1 | | | | | |
| H. L. Porter } | " | | | | | | |
| John C. Vennard & Son } | " | 1 | | | | | |
| Bartlett & Doak | " | | 1 | | | | |
| I. C. Breed | " | | 1 | | | | |
| James Phelan | " | | | 1 | | | |
| Samuel M. Bubier | " | | | | 1 | | |
| J. N. Smith | " | | 1 | | | | |
| Valpey & Anthony | " | | | | 1 | | |
| J. E. Farrar & Co. | " | | | 1 | | | |
| A. F. Smith | " | | | 1 | | | |
| O. B. Lancaster | " | | 1 | | | | |
| C. H. Aborn & Co | " | | 1 | | | | |
| Eugene Barry | " | | | 1 | | | |
| Breed, Dole & Co. | " | | | 1 | | | |
| T. P. Richardson & Co. | " | | | 1 | | | |
| D. L. Brown & Oliver | " | | | 1 | | | |
| E. N. Stowell & Rhodes | " | | 1 | | | | |
| George W. Downing | " | | 1 | | | | |
| John Mahon & Sons | " | | | | 1 | | |
| B. F. Doak & Co. | " | | | | 1 | | |
| C. A. Coffin & Co | " | | | 1 | | | |
| *Carried forward,* | | 2 | 28 | 22 | 33 | 2 | 2 |

[STATEMENT EXHIBITING THE CLASS OF PREMISES TO WHICH METERS ARE ATTACHED. — *Concluded.*]

| Name. | Class. | Size. | | | | | |
|---|---|---|---|---|---|---|---|
| | | ½ | ⅝ | ¾ | 1 | 1½ | 2 |
| *Brought forward.* | | 2 | 28 | 22 | 33 | 2 | 2 |
| C. S. Sweetser | Factory. | | | | 1 | | |
| Morgan & Dore | " | | | | 1 | | |
| E. W. & C. F. Mower | " | | 1 | | | | |
| W. H. Trask & Co | " | | | | 1 | | |
| Fred P. Burnham | " | | 1 | | | | |
| B. F. Spinney | " | | 1 | | | | |
| Healey Bros. | " | | 1 | | | | |
| H. M. Smith | " | | | | 1 | | |
| Hoitt Bros. | " | | | | 1 | | |
| Silsbee & Pickford | " | | | 1 | | | |
| W. S. Dickson | " | | | 1 | | | |
| T. P. Richardson & Co. | " | | | | 1 | | |
| P. P. Sherry | " | | | | 1 | | |
| P. P. Sherry | " | | | 1 | | | |
| John Mahon & Sons | " | | | 1 | | | |
| Odd Fellows' Hall | Building | | | | 1 | | |
| A. C. Blethen | " | | | 1 | | | |
| G. B. French | " | | | | 1 | | |
| Silsbee & Pickford | " | | | 1 | | | |
| Kirtland House | Hotel. | | 1 | | | | |
| Amos E. Mower | L. Stable | | 1 | | | | |
| L. E. Smith | " | | 1 | | | | |
| A. D. Wallace | " | | 1 | | | | |
| S. H. Sawtell | " | | 1 | | | | |
| A. B. Breed | " | | 1 | | | | |
| G. F. Burkhardt | Saloon. | | | 1 | | | |
| C. R. Blake | Laundry | | 1 | | | | |
| Lynn Gas Light Co. | GasW'ks. | | | | | 1 | |
| B. J. Berry | Dwell'ng | | 1 | | | | |
| City Steam Fire Engine House | | | | | 1 | | |
| Total | | 2 | 40 | 29 | 43 | 3 | 2 |

# REPORT OF THE SUPERINTENDENT.

*Hon. Edwin Walden, President of the Public Water Board:*

SIR: — In compliance with the City Ordinance, I respectfully submit, herewith, the Annual Report of the Superintendent for the year ending December 31, 1879.

## PONDS.

Work was commenced at Breed's Pond as soon as the weather would permit in the spring. The road at the upper end of the pond, which had become partially submerged in consequence of raising the dam, was raised so as to allow the pond to be filled to a level of twenty feet above the sill of the gate house. The dam has been filled level with the top of the coping to a width of fifteen feet on top, sloping back to a level with the coping of the retaining wall, and the slope well covered with loam and sown with grass seed. The road at the dam has been filled to the same height as the dam for a width of about forty feet, affording to visitors who drive up to view the pond, ample space in which to turn in perfect security.

The grounds below the dam, and the hillside, which were in so unsightly a condition after the removal of the old buildings, have been graded, and terraced to correspond with the wall of the waste way, the slopes well covered with loam and sown down to grass.

The inside slope of the dam has been carefully paved, which protects it from the wash of the water, and gives it a clean and more finished appearance. The margin of the pond has been cleared of all bushes, dead wood, etc., to high water mark, and the general appearance of the dam and all the surroundings has been much improved. Another season the retaining wall ought to be extended to Oak Street, and the grounds below the dam fenced to prevent the slopes from being trampled up and spoiled by cattle.

Birch Pond has required no outlay this year. The water during the heat of the summer was cloudy, and was not pumped for use in the city; with the advent of cool weather in the fall, the water became clear and of good quality, and has been in use since the early part of October. Both ponds are now in good condition, and the water of excellent quality.

Owing to the quantity of water in store at the beginning of the year, from the large rainfall of last year, there began to be a waste from Birch Pond in January. The supply for the city having been taken from Breed's Pond, no waste occurred from that pond till April. There were twenty-seven days in which there was waste from Breed's Pond, and eighty-seven days' waste from Birch Pond; the total waste from both ponds amounting to one hundred and sixty-four million gallons. On the first of January, 1879, the depth in Breed's Pond was seventeen feet five and one-half inches; the depth in Birch Pond was thirteen feet four and one-half inches. January 1, 1880, depth in Breed's Pond, eight feet; depth in Birch Pond, ten feet four inches; showing a loss in both ponds, for the year, of two hundred three and one-third million gallons.

The rainfall for the year has been 41.04 inches, which is 16.32 inches less than last year. The total yield of the water shed, which has run into the ponds, has been 42.38 per cent. of the rainfall, equal to 17.39 inches over the entire drainage area, exclusive of water surfaces, the yield amounting to 417,044,027 gallons. The consumption for the year has been 461,756,981 gallons, showing the consumption to have been 44,712,954 gallons more than the total yield of the water shed in a year of nearly average rainfall. In the report for 1877, the necessity of an increased water supply was urged, and it was then shown that the probable increase in the consumption would exhaust the whole available supply, in a year of average rainfall, by the year 1880, even if fifty per cent. could be collected for use. The consumption this year has proved the correctness of that estimate; the increase over last year has been 10.55 per cent. With the return of business prosperity, the consumption will increase still more rapidly; and with these facts in view it must be apparent that any further delay in procuring a full and ample supply must be very hazardous, and is sure to result in a water famine the first year of a diminished rainfall; nothing but the use of meters for all large consumers, and a rigid house inspection, has saved us so long.

The average daily consumption in twenty-one cities, as shown by the last report of the Boston Water Board, was fifty-nine and one-fourth gallons per inhabitant. The daily average in this city is 35.1 gallons per inhabitant.

## RESERVOIR.

The reservoir is in good condition and has required no outlay during the year, except for clearing the walk and road of weeds and grass.

## PUMPING STATION.

The buildings are in good condition and have required no repairs during the year. No repairs have been made upon the engine, and only slight repairs to the boilers and furnaces; they are all pronounced by the engineer to be in good working order. The engine has been run during the year 2190 1-4 hours; has made 2,444,095 revolutions, and pumped 456,319,019 gallons of water into the reservoir at an average height of 165 5-8 feet, after making the usual allowance for loss of action in the pump, and has given an average duty of 91,705,149 pounds of water raised one foot high for each 100 pounds of coal consumed — maintaining its previous high reputation for economy. I wish again to call your attention to the great risk run in not providing another pumping engine. The present engine has been running since January, 1873; has pumped more than 3,000,000,000 gallons of water, and has received no repairs or regular overhauling — except a new valve-chamber to the pump — since it was accepted by the city, in January, 1874. Each year the work is increasing, and notwithstanding its present good condition, like other machinery, it is liable to a break down; and a serious accident would leave us without adequate means to supply the city for more than a few days. If an accident should happen at a busy season of the year, it might prove more expensive to our citizens, in a financial point of view, than the whole cost of a new engine, in addition to the great inconvenience which the whole community must suffer.

## PIPES.

There has been no extension of street mains this year, with the exception of 1,210 feet of small pipe, laid in courts in different localities as mains. No new hydrants have been set. Three two-inch gates have been set in connection with the small pipe laid in courts. Two hundred and thirty-eight services have been put in, and thirteen services previously laid have been extended. Two stand pipes for water carts, one stand pipe for fire purposes, and a pipe for a fountain in Gold Fish Pond, have also been put in, of an aggregate length of 11,569 feet. Seventeen services have been put in East Saugus at the expense of the parties ordering them.

One hydrant has been changed; one hundred and twelve leaks in pipes and twenty hydrants have been repaired; twelve gate boxes and ten service boxes have been set to replace those decayed; and seven new meters have been set.

The usual attention has been given to the fire hydrants, and precautions taken to prevent their freezing. All the works are believed to be in good condition.

For particulars of the work done please see the tables annexed; also tables showing the engine record, consumption of water, rainfall, etc., and meteorological record for the year. A diagram is added showing the consumption of water, and the rainfall for the last six years.

All of which is respectfully submitted.

DANIEL WALDEN,

*Superintendent.*

# TABLE I.

## ENGINE RECORD FOR THE YEAR ENDING DECEMBER 31, 1879.

| | Number of Pumping Days. | Average pumping time per day. | Total pumping time per month | Total number of revolutions per month. | Average revolutions per minute. | Coal consumed. | | | | Ashes and cinders. | Ashes and cinders. | Total number of gals. pumped per month, allowing 4 per cent. for loss of action in the pump. | Av'ge number of gals. pumped into the reservoir per lb. of coal. | Average number of gals. raised 100 feet high per lb. of coal. | Av'ge head against the pump. | Average duty in pounds of water raised one foot high per 100 lbs. of coal, calculated on the total coal consumed, no deduction made for ashes and cinders | Average duty, calculated on the total coal consumed, ashes and cinders deducted. | Average duty calculated on the coal consumed while running, no deduction being made for ashes and cinders. | Average duty calculated on the coal consumed while running, the ashes and cinders being deducted. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Raising steam. | Pumping. | Banking. | Total. | | | | | | | | | | |
| Month. | Dys | H. M. | H. M. | Rev'ns. | Rev. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | p. c. | Galls. | Galls. | Galls. | Feet. | Lbs. | Lbs. | Lbs. | Lbs. |
| January . | 11 | 15 28 | 170 10 | 189,835 | 18.59 | 10,100 | 44,350 | 1,800 | 56,250 | 5,630 | 10.00 | 35,413,719 | 629.58 | 1,042.25 | 165.55 | 90,496,334 | 100,563,390 | 114,778,327 | 127,486,759 |
| February . | 9 | 15 33 | 140 00 | 156,490 | 18.63 | 8,200 | 36,700 | 1,500 | 46,400 | 5,800 | 12.28 | 29,193,209 | 629.16 | 1,041.44 | 165.53 | 90,426,840 | 103,344,960 | 114,327,122 | 130,657,534 |
| March . . | 12 | 15 25 | 185 05 | 205,750 | 18.53 | 10,000 | 49,400 | 2,400 | 61,800 | 8,370 | 13.54 | 38,382,062 | 621.08 | 1,031.47 | 166.08 | 89,560,335 | 103,590,281 | 112,041,067 | 129,590,932 |
| April . . . | 9 | 15 18 | 137 40 | 153,790 | 18.61 | 8,200 | 36,000 | 1,500 | 45,700 | 5,960 | 13.04 | 28,689,524 | 627.78 | 1,043.62 | 166.25 | 90,619,457 | 104,210,095 | 115,036,366 | 132,289,065 |
| May . . . | 12 | 15 35 | 187 00 | 208,660 | 18.59 | 10,700 | 48,700 | 2,100 | 61,500 | 8,130 | 13.22 | 38,925,523 | 632.93 | 1,058.93 | 165.73 | 91,078,054 | 104,952,226 | 115,016,434 | 132,558,033 |
| June . . . | 11 | 15 38 | 172 00 | 192,340 | 18.63 | 9,400 | 44,650 | 2,100 | 56,150 | 7,260 | 12.93 | 35,881,027 | 639.02 | 1,052.57 | 164.72 | 91,393,656 | 104,965,305 | 114,932,805 | 131,969,745 |
| July . . . | 14 | 15 34 | 218 00 | 243,610 | 18.62 | 12,000 | 55,800 | 2,700 | 70,500 | 8,535 | 12.10 | 45,445,445 | 644.61 | 1,068.55 | 165.77 | 92,780,893 | 105,560,445 | 117,223,171 | 133,368,395 |
| August . . | 16 | 15 26 | 247 00 | 276,080 | 18.63 | 13,300 | 63,900 | 2,700 | 79,900 | 10,960 | 13.72 | 51,502,724 | 644.71 | 1,067.70 | 165.61 | 92,690,461 | 107,426,282 | 115,899,341 | 134,324,256 |
| September | 12 | 15 30 | 186 05 | 207,910 | 18.62 | 10,000 | 48,100 | 2,400 | 60,500 | 7,560 | 12.49 | 38,785,610 | 641.08 | 1,064.13 | 165.99 | 92,398,571 | 105,404,487 | 116,218,576 | 132,813,341 |
| October . | 14 | 15 35 | 218 10 | 243,910 | 18.63 | 11,900 | 55,800 | 2,700 | 70,400 | 8,880 | 12.61 | 45,501,410 | 646.32 | 1,071.19 | 165.74 | 93,011,029 | 106,436,548 | 117,347,248 | 134,284,411 |
| November | 11 | 15 40 | 172 20 | 192,120 | 18.58 | 9,700 | 44,200 | 1,800 | 55,700 | 7,230 | 12.96 | 35,839,986 | 643.45 | 1,068.31 | 166.03 | 92,759,697 | 106,586,143 | 116,894,007 | 134,329,463 |
| December | 10 | 15 40 | 156 45 | 175,600 | 18.67 | 8,800 | 40,350 | 1,800 | 50,950 | 6,400 | 12.56 | 32,758,180 | 642.94 | 1,065.50 | 165.72 | 92,516,219 | 105,806,988 | 116,820,355 | 133,600,741 |
| Tot. & av's. | 141 | 15 32 | 2100 15 | 2,446,095 | 18.60 | 122,300 | 567,950 | 25,500 | 715,750 | 90,715 | 12.67 | 456,319,019 | 637.54 | 1,056.59 | 165.73 | 91,705,149 | 105,014,856 | 115,569,963 | 132,343,137 |

## COST OF PUMPING.

| | | | |
|---|---|---|---|
| 715,750 lbs. of coal, average price per net ton, $\$4.52\frac{2}{3}$ . . . | | $1,620 | 66 |
| 47,150 lbs. of coal for heating, average price per net ton, $\$4.82\frac{3}{10}$ | | 113 | 70 |
| $12\frac{1}{2}$ cords of wood, $4.50 . . . . . . . . . . . . | | 56 | 25 |
| Oil, waste, packing, etc. . . . . . . . . . . . . | | 136 | 15 |
| Sundries . . . . . . . . . . . . . . . . . | | 10 | 45 |
| Repairs to boilers and furnaces . . . . . . . . . . . | | 27 | 12 |
| Wages of Engineer and Fireman . . . . . . . . . . | | 1,960 | 00 |
| Total, . . . . . . . . . . . . . . . . . | | $3,924 | 33 |
| Cost of raising one million gallons into the reservoir . | $\$8.61\frac{31}{100}$ | | |
| Cost of raising one million gallons one foot high . . | $0.05\frac{10}{100}$ | | |

# TABLE II.

## SHOWING THE CONSUMPTION OF WATER FOR THE YEAR ENDING DECEMBER 31, 1879.

| Month. | Water drawn from Reservoir. | Average consumption per day. | Average daily increase. | Average daily decrease. | Average to each consumer. | Average to each inhabitant. |
|---|---|---|---|---|---|---|
| | Gallons. | Gallons. | Gallons. | Gallons. | Galls. | Galls. |
| January . . | 34,413,719 | 1,142,378 | 128,382 | | 50.8 | 31.7 |
| February . | 31,834,650 | 1,136,952 | | 5,414 | 50.5 | 31.6 |
| March . . . | 34,096,567 | 1,099,889 | | 37,063 | 48.9 | 30.5 |
| April . . . | 32,046,645 | 1,068,221 | | 68,731 | 47.5 | 29.7 |
| May . . . | 35,593,970 | 1,148,193 | 79,972 | | 51.0 | 31.9 |
| June . . . | 38,024,917 | 1,267,497 | 119,304 | | 56.3 | 35.2 |
| July . . . . | 45,820,772 | 1,478,089 | 210,592 | | 65.7 | 41.0 |
| August . . | 49,828,026 | 1,607,356 | 129,267 | | 71.4 | 44.6 |
| September . | 42,334,199 | 1,410,806 | | 196,550 | 62.7 | 39.2 |
| October . . | 42,726,299 | 1,378,267 | | 32,539 | 61.2 | 38.3 |
| November . | 36,856,062 | 1,228,533 | | 149,734 | 64.6 | 34.1 |
| December . | 38,181,215 | 1,231,652 | 3,119 | | 54.7 | 34.2 |
| To. and av's. | 461,756,981 | 1,265,088 | 120,764 | | 56.2 | 35.1 |

Average daily increase over 1878, 10.55 per cent.

# TABLE III.

SHOWING THE AMOUNT OF RAINFALL ON THE WATER-SHED OF BREED'S AND BIRCH PONDS, AMOUNT OF WATER CONSUMED, AMOUNT WASTED, AMOUNT RECEIVED INTO THE PONDS, AND PERCENTAGE OF RAINFALL AVAILABLE FOR USE, FROM 1874 TO 1879, INCLUSIVE.

| Date. | Rainfall. | Amount of rainfall on water-shed. | Amount of water drawn from the ponds for consumption. | Amount of water wasted from the ponds. | Total amount consumed and wasted. | Increase in ponds during the year. | Decrease in ponds during the year. | Total amount of rainfall received into the ponds. | Daily average. | Percentage of rainfall received into the ponds. |
|---|---|---|---|---|---|---|---|---|---|---|
| Year. | Inches | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | per cent. |
| 1874 | 34.92 | 837,154,949 | 485,189,801 | 21,200,000 | 506,389,801 | | 47,545,394 | 458,844,407 | 1,257,108 | 54.81 |
| 1875 | 41.85 | 1,003,305,644 | 471,387,757 | 11,609,267 | 482,997,024 | 60,281,293 | | 543,278,317 | 1,488,433 | 54.24 |
| 1876 | 45.05 | 1,080,099,392 | 395,084,629 | 20,500,000 | 415,584,629 | 74,452,111 | | 490,036,740 | 1,342,566 | 45.37 |
| 1877 | 45.65 | 1,094,484,734 | 402,161,193 | 131,271,511 | 533,438,704 | 60,846,704 | | 594,285,408 | 1,628,179 | 54.29 |
| 1878 | 57.36 | 1,379,911,034 | 417,678,296 | 205,081,247 | 622,759,543 | 64,712,199 | | 687,471,742 | 1,883,484 | 49.82 |
| 1879 | 41.04 | 983,957,360 | 456,319,019 | 164,095,022 | 620,414,041 | | 203,370,014 | 417,044,027 | 1,142,586 | 42.38 |

# TABLE II.

## SHOWING THE CONSUMPTION OF WATER FOR THE YEAR ENDING DECEMBER 31, 1879.

| | Water drawn from Reservoir. | Average consumption per day. | Average daily increase. | Average daily decrease. | Average to each consumer. | Average to each inhabitant. |
|---|---|---|---|---|---|---|
| Month. | Gallons. | Gallons. | Gallons. | Gallons. | Galls. | Galls. |
| January . . | 34,413,719 | 1,142,378 | 128,382 | | 50.8 | 31.7 |
| February . | 31,834,650 | 1,136,952 | | 5,414 | 50.5 | 31.6 |
| March . . . | 34,096,567 | 1,099,889 | | 37,063 | 48.9 | 30.5 |
| April . . . | 32,046,645 | 1,068,221 | | 68,731 | 47.5 | 29.7 |
| May . . . | 35,593,970 | 1,148,193 | 79,972 | | 51.0 | 31.9 |
| June . . . | 38,024,917 | 1,267,497 | 119,304 | | 56.3 | 35.2 |
| July . . . . | 45,820,772 | 1,478,089 | 210,592 | | 65.7 | 41.0 |
| August . . | 49,828,026 | 1,607,356 | 129,267 | | 71.4 | 44.6 |
| September . | 42,334,199 | 1,410,806 | | 196,550 | 62.7 | 39.2 |
| October . . | 42,726,299 | 1,378,267 | | 32,539 | 61.2 | 38.3 |
| November . | 36,856,002 | 1,228,533 | | 149,734 | 64.6 | 34.1 |
| December . | 38,181,215 | 1,231,652 | 3,119 | | 54.7 | 34.2 |
| To. and av's. | 461,756,981 | 1,265,088 | 120,764 | | 56.2 | 35.1 |

Average daily increase over 1878, 10.55 per cent.

## DIAGRA ,FOR THE LAST SIX YEARS.

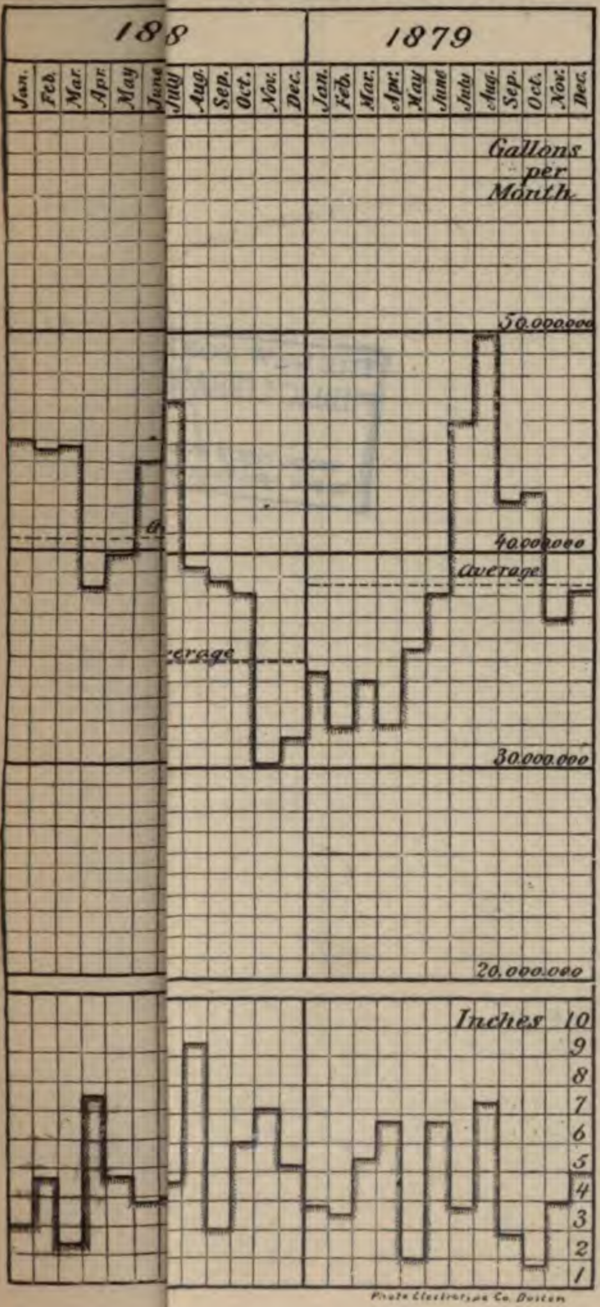

Photo Electrotype Co. Boston

# TABLE IV.

## SHOWING THE DEPTH OF WATER IN THE PONDS FOR EACH WEEK DURING THE YEAR 1879.

| Date. | | Breed's Pond. | | Birch Pond. | | Date. | | Breed's Pond. | | Birch Pond. | | Date. | | Breed's Pond. | | Birch Pond. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ft. | In. | Ft. | In. | | | [illegible] | [illegible] | Ft. | In. | | | Ft. | In. | Ft. | In |
| Jan. | 4 | 17 | 4½ | 13 | 4 | May | [illegible] | [illegible] | [illegible] | 14 | 7 | Sept. | 6 | 12 | 2 | 13 | 10½ |
| | 11 | 17 | 3½ | 13 | 6 | | [illegible] | [illegible] | [illegible] | 14 | 6 | | 13 | 11 | 7 | 13 | 9½ |
| | 18 | 16 | 11 | 13 | 7 | | [illegible] | [illegible] | [illegible] | 14 | 6 | | 20 | 10 | 11 | 13 | 8 |
| | 25 | 16 | 8½ | 13 | 7 | | [illegible] | [illegible] | [illegible] | 14 | 6 | | 27 | 10 | 2½ | 13 | 6½ |
| Feb. | 1 | 16 | 4½ | 13 | 6½ | | [illegible] | [illegible] | [illegible] | 14 | 5½ | Oct. | 4 | 9 | 5 | 13 | 6 |
| | 8 | 16 | 1½ | 13 | 6½ | June | [illegible] | [illegible] | [illegible] | 14 | 6 | | 11 | 8 | 6 | 13 | 3½ |
| | 15 | 16 | 3½ | 13 | 7½ | | 14 | [illegible] | [illegible] | 14 | 5 | | 18 | 7 | 10 | 13 | 0 |
| | 22 | 16 | 2 | 13 | 6¾ | | 21 | [illegible] | [illegible] | 14 | 5½ | | 25 | 7 | 5 | 12 | 7½ |
| March | 1 | 16 | 3½ | 13 | 7½ | | 28 | [illegible] | [illegible] | 14 | 4½ | Nov. | 1 | 7 | 2 | 12 | 2½ |
| | 8 | 16 | 3 | 13 | 7 | July | 5 | [illegible] | [illegible] | 14 | 4½ | | 8 | 7 | 1 | 12 | 0 |
| | 15 | 16 | 6½ | 12 | 6 | | 12 | [illegible] | [illegible] | 14 | 3½ | | 15 | 6 | 11 | 11 | 8 |
| | 22 | 17 | 2 | 13 | 6 | | 19 | [illegible] | [illegible] | 14 | 2 | | 22 | 6 | 10 | 11 | 5 |
| | 29 | 18 | 5 | 13 | 8 | | 26 | [illegible] | [illegible] | 14 | 0 | | 29 | 7 | 0 | 11 | 2 |
| April | 5 | 19 | 0 | 13 | 10 | Aug. | 2 | [illegible] | [illegible] | 13 | 11½ | Dec. | 6 | 6 | 11 | 10 | 10 |
| | 12 | 19 | 2 | 14 | 2 | | 9 | [illegible] | [illegible] | 13 | 9½ | | 13 | 7 | 0½ | 10 | 7½ |
| | 19 | 19 | 9 | 14 | 8 | | 16 | 13 | 5½ | 13 | 7½ | | 20 | 7 | 4½ | 10 | 4 |
| | 26 | 20 | 1 | 14 | 7 | | 23 | 13 | 9 | 14 | ½ | | 27 | 7 | 7 | 10 | 4 |
| | | | | | | | 30 | 12 | 9 | 13 | 11½ | | | | | | |

# DIAGRA ,FOR THE LAST SIX YEARS.

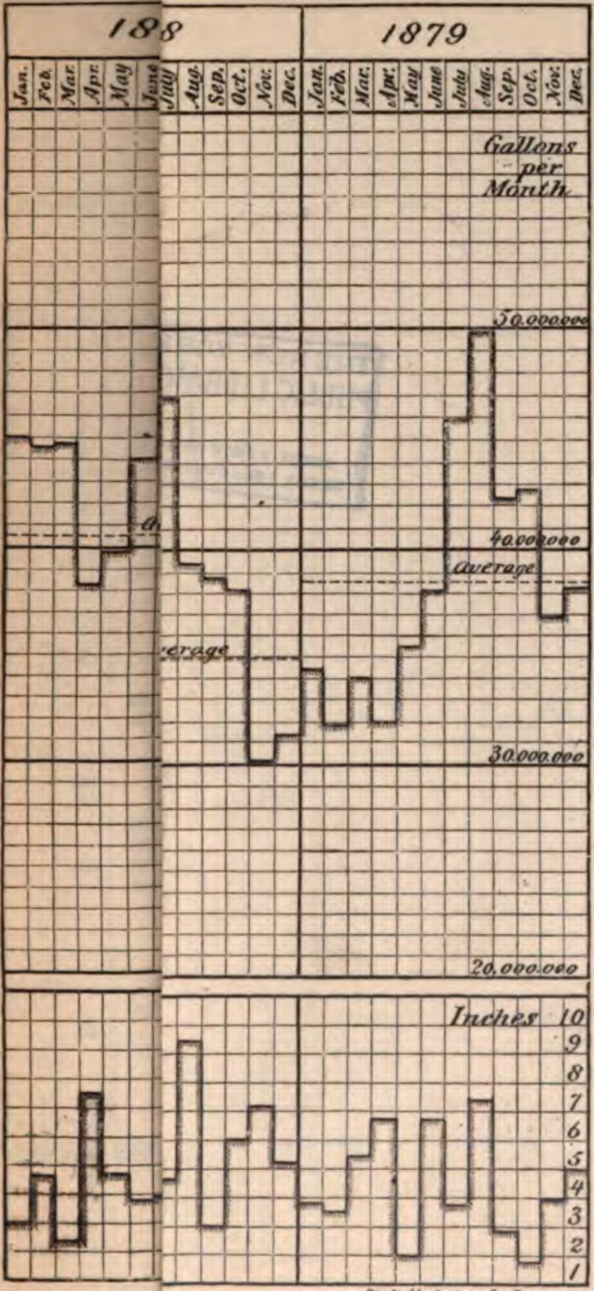

Photo Electrotype Co. Boston

# TABLE VI.

## SHOWING THE PIPE LAID IN COURTS IN 1879.

| Name of Court. | | | Size of Pipe. | | | |
|---|---|---|---|---|---|---|
| Court. | From. | To. | 2 | 1½ | 1¼ | 1 |
| Bickford . . . | Extension . . | End of Court . | | | 53.7 | |
| Wave . . . . | Ocean . . . . | End of Court . | 356.0 | 138.8 | 47.5 | 19.7 |
| Sutton . . . . | Essex . . . . | | 148.7 | | | |
| Blossom . . . | Harbor . . . . | | 131.7 | 117.7 | | |
| Norcross . . . | Extension . . | End of Court . | | 163.1 | | |
| Fayette . . . . | Extension . . | Logan . . . . | | 34.7 | | |
| | | | 636.2 | 453.11 | 101.0 | 19.7 |

| | | |
|---|---|---|
| **Total extension in 1879** . . . . . . . . . . . . | | **1,210 feet.** |
| **Previously laid** . . . . . . . . . . . . . . . . | **52 miles,** | **1,584 "** |
| Total pipe laid to Jan. 1, 1880 . . . . . . | 52 " | 2,794 " |

Total miles of distributing pipe connected with the Works: —

| | | |
|---|---|---|
| Lynn . . . . . . . . . . . . . . . . . . . . . . | 52 miles, | 2,794 feet. |
| Saugus . . . . . . . . . . . . . . . . . . . . . | 1 " | 530 " |
| Swampscott . . . . . . . . . . . . . . . . . | | 1,778 " |
| Total . . . . . . . . . . . . . . . . . . . | 53 " | 5,102 " |

# TABLE V.

## SHOWING THE RAINFALL AT THE PUMPING STATION FOR THE YEAR 1879.

| Day of the month. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | . . | . . | . . | . . | . . | . . | . . | . . | . . | . . | . . | . . |
| 2 | .58 | . . | . . | . . | . . | .25 | . . | . . | . . | . . | .01 | . . |
| 3 | . . | . . | . . | .30 | . . | .65 | . . | . . | .75 | . . | .44 | .10 |
| 4 | . . | . . | .02 | . . | . . | .53 | .14 | .02 | .04 | . . | . . | . . |
| 5 | . . | .16 | . . | . . | .02 | .08 | . . | .16 | . . | . . | .01 | . . |
| 6 | . . | . . | .20 | . . | . . | .11 | . . | . . | . . | . . | .22 | .52 |
| 7 | . . | . . | . . | . . | . . | .03 | .34 | .03 | .31 | . . | .04 | . . |
| 8 | . . | . . | .03 | . . | . . | . . | .50 | .03 | .23 | . . | . . | .02 |
| 9 | 1.30 | . . | .04 | . . | . . | .03 | .01 | . . | . . | . . | . . | . . |
| 10 | . . | . . | .03 | 1.50 | . . | .02 | . . | . . | . . | .06 | . . | .12 |
| 11 | . . | .82 | . . | .03 | . . | .01 | . . | . . | . . | .01 | .05 | . . |
| 12 | . . | .02 | . . | . . | . . | .01 | . . | . . | . . | . . | .35 | . . |
| 13 | . . | . . | . . | . . | . . | . . | . . | . . | .17 | . . | .03 | . . |
| 14 | . . | . . | .20 | . . | . . | .08 | . . | . . | .11 | . . | . . | 1.00 |
| 15 | .09 | . . | . . | .30 | . . | 1.50 | . . | . . | . . | . . | . . | .01 |
| 16 | .67 | . . | .20 | . . | .05 | .05 | .29 | .87 | .02 | . . | . . | . . |
| 17 | . . | .38 | .52 | .66 | . . | .01 | . . | .17 | . . | . . | .04 | . . |
| 18 | . . | .05 | . . | 1.15 | .02 | . . | .13 | 4.55 | .02 | .33 | .82 | . . |
| 19 | .15 | .10 | . . | .22 | .77 | . . | . . | . . | . . | . . | .12 | .04 |
| 20 | . . | .19 | .03 | . . | .03 | . . | . . | . . | . . | . . | .25 | .01 |
| 21 | . . | . . | .09 | . . | .02 | . . | . . | . . | . . | .03 | . . | .20 |
| 22 | . . | . . | .82 | . . | . . | . . | .08 | .01 | .02 | .06 | .09 | .47 |
| 23 | . . | . . | .14 | . . | . . | . . | .02 | . . | . . | .01 | . . | .25 |
| 24 | . . | . . | . . | . . | . . | . . | . . | . . | .27 | . . | . . | .30 |
| 25 | . . | .42 | .02 | .14 | . . | .01 | . . | .20 | . . | . . | . . | .06 |
| 26 | . . | .43 | . . | . . | . . | .08 | 1.30 | . . | . . | . . | . . | . . |
| 27 | .01 | . . | 1.14 | . . | .06 | . . | . . | . . | . . | .27 | . . | . . |
| 28 | . . | . . | .01 | .41 | . . | .10 | .02 | . . | . . | . . | .27 | .03 |
| 29 | . . | . . | .16 | .70 | . . | 2.15 | . . | .42 | . . | . . | .16 | .15 |
| 30 | . . | . . | .05 | .25 | . . | . . | . . | . . | . . | . . | . . | . . |
| 31 | . . | . . | .76 | . . | . . | . . | . . | . . | . . | . . | . . | .70 |
| Totals | 2.80 | 2.57 | 4.46 | 5.66 | .97 | 5.70 | 2.83 | 6.46 | 1.94 | .77 | 2.90 | 3.98 |

# TABLE VI.

## SHOWING THE PIPE LAID IN COURTS IN 1879.

| Name of Court. | | | Size of Pipe. | | | |
|---|---|---|---|---|---|---|
| Court. | From. | To. | 2 | 1½ | 1¼ | 1 |
| Bickford . . . | Extension . . | End of Court . | | | 53.7 | |
| Ware . . . . | Ocean . . . . | End of Court . | 356.0 | 138.8 | 47.5 | 19.7 |
| Sutton . . . . | Essex . . . . | | 148.7 | | | |
| Blossom . . . | Harbor . . . . | | 131.7 | 117.7 | | |
| Norcross . . . | Extension . . | End of Court . | | 163.1 | | |
| Fayette . . . . | Extension . . | Logan . . . . | | 34.7 | | |
| | | | 636.2 | 453.11 | 101.0 | 19.7 |

| | | |
|---|---|---|
| Total extension in 1879 . . . . . . . . . . . . | | 1,210 feet. |
| Previously laid . . . . . . . . . . . . . . . . . | 52 miles, | 1,584 " |
| Total pipe laid to Jan. 1, 1880 . . . . . . . | 52 " | 2,794 " |

Total miles of distributing pipe connected with the Works: —

| | | |
|---|---|---|
| Lynn . . . . . . . . . . . . . . . . . . . . . . | 52 miles, | 2,794 feet. |
| Saugus . . . . . . . . . . . . . . . . . . . . | 1 " | 530 " |
| Swampscott . . . . . . . . . . . . . . . . | | 1,778 " |
| Total . . . . . . . . . . . . . . . . . . | 53 " | 5,102 " |

# TABLE VII.

## SHOWING THE LOCATION OF GATES SET IN 1879.

| Street. | Location. | Size. |
|---|---|---|
| | | Inches. |
| Wave . . . | 12 ft. 10 in. E. from the W. line of Wave St. . . | |
| | 1 ft. N. from the S. line of Ocean St. . . . . . . | 2 |
| Sutton . . | 18 ft. 6 in. S. from the N. line of Sutton St. . . . | |
| | 1 ft. E. from the E. line of Essex St. . . . . . . | 2 |
| Blossom . . | 11 ft. 5 in. W. from the E. line of Blossom St. . . | |
| | 1 ft. S. from the S. line of Harbor St. . . . . . | 2 |

| | |
|---|---|
| Total gates set in 1879 . . . . . . . . . . . . . . . . . . . . . . | 3 |
| Gates previously set . . . . . . . . . . . . . . . . . . . . . . . | 357 |
| Total number of gates set to January 1, 1880 . . . . . . . | 360 |

No new hydrants have been set this year.

Total number of hydrants set to January 1, 1880—381.

# TABLE VIII.

SHOWING THE NUMBER AND SIZE OF SERVICES PUT IN, IN 1879.

| Month. | Size of Pipe. | | | | | | | | | | Total. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 inch. | | 1½ inch. | | 1¼ inch. | | 1 inch. | | ¾ inch. | | | |
| | No. | Length. | No. | Length. | No. | Length. | No. | Length. | No | Length. | No. | Length. |
| January | | | | | | | | | | | | |
| February | | | | | | | | | | | | |
| March | | | | | | | | | | | | |
| April | | | | | | | 2 | 142.7 | 14 | 554.4 | 16 | 696.11 |
| May | 1 | 27.8 | | | 2 | 31.9 | 2 | 237.4 | 39 | 488.6 | 44 | 1,785.3 |
| June | 1 | 26.6 | 2 | 162.4 | 1 | 20.2 | 6 | 585.7 | 18 | 686.8 | 28 | 1,481.3 |
| July | | | | | | | 3 | 414.3 | 24 | 772.1 | 27 | 1,186.4 |
| August | | | 2 | 108.2 | 1 | 36.2 | 4 | 179.10 | 23 | 909.1 | 30 | 1,233.3 |
| September | 1 | 16.1 | | | | | 1 | 113.4 | 17 | 815.4 | 19 | 944.9 |
| October | | | | | 1 | 85.6 | 5 | 592.9 | 22 | 993.6 | 28 | 1,672.1 |
| November | | | | | 1 | 115.0 | 2 | 127.8 | 27 | 1,180.1 | 30 | 1,422.9 |
| December | | | | | | | 1 | 190.6 | 19 | 956.7 | 20 | 1,147.1 |
| | 3 | 70.3 | 4 | 270.6 | 6 | 288.7 | 26 | 2,583.10 | 203 | 8,356.2 | 242 | 11,569.8 |

| | | | |
|---|---|---|---|
| Length of service pipe laid in 1879 | 2 miles, | 1,069 | feet. |
| Length previously laid | 31 " | 3,590 | " |
| Total to January 1, 1880 | 33 " | 4,599 | " |
| Length of service pipe laid in Saugus in 1879 | | 864.7 | feet. |
| Length previously laid | | 1,333 | " |
| Total laid in Saugus to January 1, 1880 | | 2,197.7 | |

# TABLE IX.

## REPAIRS ON PIPES, GATES AND HYDRANTS, FOR THE YEAR 1879.

| Month. | Size of pipe. | | | | | | | | | | | Size of gate. | | | | | | Hydrants. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 16 | 12 | 10 | 8 | 6 | 4 | 2 | 1½ | 1¼ | 1 | ¾ | 16 | 12 | 10 | 8 | 6 | 4 | |
| January | | | | | 6 | 3 | | | | 1 | | | | | | | | 1 |
| February | 1 | | | | | 3 | | | | | | | | | | | | 2 |
| March | 1 | | | | 4 | 1 | | | | 2 | | | | | | | | 3 |
| April | 1 | | | 2 | 2 | 1 | | | | 1 | | | | | | | | 4 |
| May | | | | | 3 | 3 | | | | 1 | | | | | | | | |
| June | | | 1 | 2 | 2 | 3 | | | | | | | | | | | | 4 |
| July | 1* | | | | 5 | 4 | | | | | 1 | | | | | | | 3 |
| August | | | | | 9 | 5 | | | | | | | | | | | | 1 |
| September | 1 | 2 | | | 6 | 2 | 1 | | | | | | | | | | | 1 |
| October | | 2 | | | 10 | 3 | | | | | 1 | | | | | | | |
| November | | | | | 3 | 3 | | | | | 2 | | | | | | | |
| December | | | | 1 | 6 | 1 | | | | | | | | | | | | 1 |
| Totals | 4 | 4 | 1 | 5 | 56 | 32 | 1 | | | 5 | 4 | | | | | | | 20 |

*Twenty-inch pipe.

## METEOROLOGICAL RECORD FOR JANUARY, 1879.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | ermometer. | midity. | rometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.16 | 17° | 83 | 30.14 | 32 | [illegible] | [illegible] | 31° | 63 | 33° | 21° | 12° | 27° | .00 |
| 2 | 29.76 | 28 | 95 | 29.46 | 34. | [illegible] | [illegible] | 29 | 88 | 34 | 7 | 27 | 20.5 | .51 |
| 3 | 29.30 | 7 | 54 | 29.20 | 14 | [illegible] | [illegible] | 14.5 | 56 | 17 | 7.5 | 9.5 | 12.2 | .00 |
| 4 | 29.09 | 16 | 75 | 29.23 | 23 | [illegible] | [illegible] | 24 | 74 | 26.5 | 18 | 8.5 | 22.2 | .00 |
| 5 | 29.63 | 18.5 | 77 | 29.62 | 28. | [illegible] | [illegible] | 24.5 | 55 | 31 | 11 | 20 | 21 | .00 |
| 6 | 29.77 | 15.5 | 75 | 29.82 | 21. | [illegible] | [illegible] | 20.5 | 50 | 25 | 9 | 16 | 17 | .00 |
| 7 | 30.11 | 9 | 79 | 30.22 | 22 | [illegible] | [illegible] | 23 | 73 | 31 | 10 | 21 | 20.5 | .00 |
| 8 | 30.09 | 29.5 | 78 | 30.00 | [illegible] | [illegible] | [illegible] | 35 | 80 | 40 | 32 | 8 | 36 | .08 |
| 9 | 29.90 | 35 | 85 | 29.75 | [illegible] | [illegible] | [illegible] | 34 | 85 | 38 | 12 | 26 | 25 | .74 |
| 10 | 29.87 | 12 | 61 | 30.15 | [illegible] | [illegible] | [illegible] | 21 | 64 | 23 | 10 | 13 | 16.5 | .00 |
| 11 | 30.37 | 15.5 | 75 | 30.34 | [illegible] | [illegible] | [illegible] | 28 | 82 | 32 | 16.5 | 15.5 | 24.2 | .00 |
| 12 | 30.32 | 16.5 | 75 | 30.29 | [illegible] | [illegible] | [illegible] | 24 | 74 | 32 | 18 | 14 | 25 | .00 |
| 13 | 30.10 | 19.5 | 77 | 30.01 | [illegible] | [illegible] | [illegible] | 32 | 84 | 37 | 22 | 15 | 29.5 | .00 |
| 14 | 29.91 | 29.5 | 73 | 29.88 | 36.5 | 81 | [illegible] | 34 | 75 | 38 | 8 | 30 | 23 | .00 |
| 15 | 30.17 | 7.5 | 43 | 30.29 | 7.5 | 28 | 30.36 | 6 | 52 | 11 | 5 | 6 | 8 | .10 |
| 16 | 30.24 | 7 | 65 | 29.97 | 13.5 | 82 | 29,88 | 12 | 80 | 18 | 7 | 11 | 12.5 | .30 |
| 17 | 30.31 | 12.5 | 71 | 30.36 | 24 | 67 | 30.33 | 25 | 81 | 35 | 13 | 22 | 24 | .02 |
| 18 | 29.86 | 34 | 90 | 29.73 | 37 | 76 | 29.78 | 34 | 75 | 40 | 20.5 | 19.5 | 30.2 | .00 |
| 19 | 29.91 | 21 | 79 | 29.87 | 32 | 79 | 29.84 | 25,5 | 74 | 33 | 18 | 15 | 25.5 | .08 |
| 20 | 29.65 | 18 | 68 | 29.71 | 22 | 51 | 29.78 | 19 | 53 | 25 | 0 | 25 | 12.5 | .00 |
| 21 | 29.90 | 5 | 40 | 30.01 | 27 | 64 | 30.01 | 20 | 33 | 30 | 3.5 | 26.5 | 16.7 | .03 |
| 22 | 29.76 | 30 | 67 | 29.94 | 38.5 | 60 | 30.04 | 34 | 70 | 41 | 28 | 13 | 34.5 | .00 |
| 23 | 29.90 | 36.5 | 71 | 29.84 | 39 | 56 | 29.98 | 35 | 62 | 40 | 22 | 18 | 31 | .00 |
| 24 | 30.30 | 24 | 48 | 30.26 | 34 | 62 | 30.15 | 35 | 62 | 38 | 25 | 13 | 31.5 | .00 |
| 25 | 29.82 | 34 | 62 | 29.70 | 43.5 | 63 | 29.50 | 42 | 66 | 43 | 3.5 | 39.5 | 23.2 | .00 |
| 26 | 30.07 | 3.5 | 47 | 30.17 | 11 | 30 | 30.30 | 7 | 33 | 18 | 5 | 13 | 11.5 | .00 |
| 27 | 30.38 | 17 | 35 | 30.12 | 27 | 76 | 29.94 | 37 | 72 | 40 | 18 | 22 | 29 | .01 |
| 28 | 29.84 | 40 | 65 | 29.88 | 47 | 70 | 29.96 | 46 | 69 | 51 | 31 | 20 | 41 | .00 |
| 29 | 30.14 | 33 | 61 | 30.19 | 30 | 62 | 30.22 | 24 | 61 | 33 | 11 | 22 | 22 | .00 |
| 20 | 30.18 | 13 | 35 | 30.13 | 27 | 52 | 30.10 | 27.5 | 71 | 32 | 12.5 | 19.5 | 22.2 | .00 |
| 31 | 29.92 | 28 | 68 | 29.76 | 37 | 63 | 29.68 | 33 | 70 | 39 | 22 | 17 | 30.5 | .00 |

| | |
|---|---|
| Monthly range . . . . . . . . . . . . . . . . | 51° |
| Monthly mean . . . . . . . . . . . . . . . . | 23°.41 |
| Monthly rainfall . . . . . . . . . . . . . . . | 1.87 |

## METEOROLOGICAL RECORD FOR FEBRUARY, 1879.

| Date. | 8 A. M. |  |  | 1 P. M. |  |  | 6 P. M. |  |  | 24 hours ending 8 A. M. |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.58 | 23° | 60 | 29.55 | 26° | 40 | 29.52 | 20° | 27 | 26°.5 | 12° | 14°.5 | 19°.2 | .00 |
| 2 | 29.39 | 13.5 | 53 | 29.39 | 25 | 69 | 29.43 | 25.5 | 69 | 29 | 15 | 14 | 22 | .00 |
| 3 | 29.60 | 24.5 | 43 | 29.63 | 32 | 59 | 29.64 | 32 | 69 | 35 | 24.5 | 10.5 | 29.7 | .00 |
| 4 | 29.68 | 27 | 64 | 29.76 | 33 | 51 | 29.86 | 32 | 73 | 34 | 22 | 12 | 28 | .00 |
| 5 | 29.97 | 25 | 38 | 29.92 | 34.5 | 53 | 29.82 | 32 | 55 | 36 | 24 | 12 | 30 | .16 |
| 6 | 29.82 | 26 | 63 | 29.90 | 36 | 63 | 29.88 | 34 | 62 | 38 | 21 | 17 | 29.5 | .00 |
| 7 | 30.02 | 22 | 44 | 30.06 | 31 | 70 | 30.02 | 32 | 64 | 34 | 22 | 12 | 28 | .00 |
| 8 | 30.27 | 23.5 | 41 | 30.32 | 29 | 51 | 30.34 | 27 | 53 | 30.5 | 17.5 | 13 | 24 | .00 |
| 9 | 30.24 | 26.5 | 82 | 30.06 | 36.5 | 71 | 30.07 | 26.5 | 70 | 34 | 11 | 23 | 22.5 | .01 |
| 10 | 30.40 | 12 | 42 | 30.49 | 21 | 36 | 30.46 | 24 | 48 | 34 | 11 | 23 | 22.5 | .00 |
| 11 | 30.28 | 34 | 62 | 30.15 | 42 | 76 | 29.99 | 43 | 75 | 48 | 32 | 16 | 40 | 1.53 |
| 12 | 29.32 | 43 | 95 | 29.18 | 44 | 84 | 29.36 | 36 | 71 | 46 | 29.5 | 16.5 | 37.7 | .05 |
| 13 | 29.71 | 30 | 67 | 29.75 | 31 | 68 | 29.83 | 28 | 65 | 33 | 15 | 18 | 24 | .00 |
| 14 | 30.10 | 16 | 33 | 30.11 | 21 | 29 | 30.19 | 20 | 39 | 24.5 | 11 | 13.5 | 17.7 | .00 |
| 15 | 30.32 | 12 | 36 | 30.38 | 20 | 39 | 30.38 | 20 | 47 | 24 | 11.5 | 12.5 | 17.7 | .00 |
| 16 | 30.48 | 16 | 57 | 30.45 | 29 | 66 | 30.42 | 31 | 58 | 34 | 18 | 16 | 26 | .00 |
| 17 | 30.45 | 25 | 68 | 30.45 | 33 | 90 | 30.38 | 30 | 67 | 34.5 | 22 | 12.5 | 28.2 | .36 |
| 18 | 30.09 | 22 | 86 | 30.10 | 24 | 74 | 30.16 | 22 | 72 | 26 | 11 | 15 | 18.5 | .03 |
| 19 | 30.35 | 12 | 61 | 30.40 | 20 | 56 | 30.40 | 19 | 69 | 25 | 12 | 13 | 18.5 | .12 |
| 20 | 30.14 | 18.5 | 77 | 30.95 | 28 | 77 | 30.90 | 21 | 71 | 32 | 15 | 17 | 23.5 | .07 |
| 21 | 29.75 | 15 | 47 | 29.76 | 28 | 65 | 29.80 | 13.5 | 53 | 21 | 11.5 | 09.5 | 16.2 | .00 |
| 22 | 29.90 | 12 | 43 | 29.90 | 22.5 | 53 | 29.85 | 26 | 63 | 29 | 14 | 15 | 21.5 | .00 |
| 23 | 29.75 | 22.5 | 66 | 29.72 | 38 | 47 | 29.63 | 34 | 66 | 40 | 19 | 21 | 29.5 | .01 |
| 24 | 29.69 | 18 | 39 | 29.77 | 22 | 44 | 29.82 | 20 | 41 | 24.5 | 09 | 14.5 | 16.7 | .00 |
| 25 | 30.08 | 13 | 39 | 30.18 | 22 | 59 | 30.12 | 24 | 61 | 35 | 15 | 20 | 25 | .34 |
| 26 | 29.96 | 25 | 81 | 29.90 | 41 | 74 | 29.83 | 45.5 | 80 | 49 | 22.5 | 26.5 | 35.7 | .57 |
| 27 | 30.09 | 24 | 68 | 30.27 | 24 | 61 | 30.68 | 23 | 60 | 27 | 07 | 20 | 17 | .00 |
| 28 | 30.63 | 8 | 36 | 30.75 | 17 | 50 | 30.80 | 17 | 37 | 20 | 7 | 13 | 17 | .00 |

Monthly range . . . . . . . . . . . . . . . 42°

Monthly mean . . . . . . . . . . . . . . . 24°.35

Monthly rainfall . . . . . . . . . . . . . . . 3.25

## METEOROLOGICAL RECORD FOR MARCH, 1879.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.78 | 16° | 49 | 30.69 | 30° | 67 | 30.52 | 28° | 65 | 33°.5 | 17°.5 | 16° | 25°.5 | .00 |
| 2 | 30.44 | 28 | 65 | 30.48 | 31.5 | 74 | 30.48 | 32 | 50 | 35 | 24 | 11 | 29.5 | .00 |
| 3 | 30.55 | 27 | 58 | 30.66 | 32.5 | 65 | 30.68 | 31 | 64 | 35 | 27 | 8 | 31 | .00 |
| 4 | 30.63 | 30 | 73 | 30.47 | 41 | 66 | 30.30 | 40.5 | 77 | 44 | 30 | 14 | 37 | .00 |
| 5 | 30.26 | 39 | 68 | 30.33 | 43 | 58 | 30.48 | 30 | 56 | 45 | 15 | 30 | 30 | .00 |
| 6 | 30.63 | 18 | 52 | 30.50 | 26 | 69 | 30.23 | 30 | 67 | 38 | 18 | 20 | 28 | .07 |
| 7 | 29.87 | 31 | 68 | 29.96 | 32 | 59 | 30.20 | 24 | 61 | 23 | 17 | 6 | 20 | .00 |
| 8 | 30.36 | 20 | 54 | 30.40 | 28 | 65 | 30.40 | 29 | 55 | 34.5 | 21.5 | 13 | 28 | .08 |
| 9 | 30.36 | 30 | 60 | 30.32 | 35.5 | 67 | 30.23 | 32.5 | 84 | 37 | 30 | 7 | 33.5 | .02 |
| 10 | 30.12 | 35 | 90 | 30.12 | 45 | 76 | 30.19 | 49 | 85 | 54 | 32 | 22 | 43 | .02 |
| 11 | 29.92 | 40 | 82 | 29.97 | 50 | 78 | 29.77 | 48 | 70 | 56.5 | 33 | 23.5 | 44.7 | .00 |
| 12 | 30.00 | 34 | 70 | 30.02 | 38.5 | 60 | 30.18 | 37 | 72 | 42 | 29.5 | 12.5 | 35.7 | .00 |
| 13 | 30.16 | 31 | 68 | 30.11 | 39 | 64 | 29.98 | 40.5 | 77 | 44 | 33 | 11 | 38.5 | .00 |
| 14 | 30.05 | 37 | 81 | 29.96 | 41 | 83 | 29.78 | 43 | 96 | 44 | 33.5 | 10.5 | 38.7 | .20 |
| 15 | 29.75 | 33.5 | 57 | 29.83 | 38 | 72 | 29.89 | 34 | 60 | 41 | 25 | 16 | 33 | .00 |
| 16 | 30.10 | 26.5 | 70 | 30.12 | 36.5 | 76 | 30.11 | 32 | 55 | 48 | 27 | 21 | 32.5 | .13 |
| 17 | 30.10 | 31 | 95 | 29.83 | 36 | 90 | 29.76 | 35 | 90 | 40 | 24 | 16 | 32 | .46 |
| 18 | 30.04 | 24 | 61 | 30.07 | 33 | 75 | 30.07 | 32 | 50 | 34.5 | 20 | 14.5 | 27.2 | .00 |
| 19 | 30.19 | 23 | 73 | 30.19 | 35.5 | 62 | 30.15 | 31 | 53 | 38 | 24.5 | 13.5 | 31.2 | .00 |
| 20 | 30.23 | 31 | 79 | 30.23 | 37 | 63 | 30.21 | 37 | 59 | 40.5 | 25 | 15.5 | 32.7 | .05 |
| 21 | 30.11 | 33.5 | 95 | 29.96 | 36 | 95 | 30.95 | 36.5 | 85 | 38.5 | 28 | 10.5 | 33.2 | .05 |
| 22 | 30.33 | 31 | 56 | 29.36 | 34.5 | 53 | 30.29 | 33.5 | 70 | 37.5 | 30.5 | 7 | 34 | 1.42 |
| 23 | 29.85 | 29 | 95 | 29.91 | 36.5 | 85 | 29.98 | 40 | 65 | 43 | 29.5 | 13.5 | 36.2 | .03 |
| 24 | 30.02 | 32 | 69 | 30.21 | 38 | 68 | 30.11 | 38.5 | 64 | 41.5 | 33 | 8.5 | 37.2 | .00 |
| 25 | 30.02 | 38.5 | 86 | 29.99 | 49 | 70 | 29.99 | 41 | 74 | 50.5 | 33 | 17.5 | 41.7 | .01 |
| 26 | 30.10 | 33 | 75 | 30.19 | 41 | 66 | 30.21 | 35.5 | 71 | 41.5 | 35 | 6.5 | 38.2 | .00 |
| 27 | 30.24 | 35 | 90 | 30.20 | 36 | 100 | 30.17 | 35 | 100 | 37.5 | 33 | 4.5 | 35.2 | 1.02 |
| 28 | 30.19 | 33 | 100 | 30.18 | 34 | 85 | 30.19 | 36 | 85 | 37.5 | 33 | 4.5 | 35.2 | .01 |
| 29 | 29.80 | 36 | 85 | 29.84 | 37 | 100 | 29.70 | 36 | 100 | 40.5 | 33.5 | 7 | 37 | .19 |
| 30 | 29.55 | 37 | 90 | 29.36 | 46 | 69 | 29.38 | 45.5 | 69 | 50 | 35 | 15 | 42.5 | .02 |
| 31 | 29.39 | 35 | 71 | 29.23 | 35 | 90 | 29.02 | 29 | 100 | 38 | 26 | 12 | 32 | .16 |

| | |
|---|---|
| Monthly range . . . . . . . . . . . . . . . . | 41°.5 |
| Monthly mean . . . . . . . . . . . . . . . . | 34°.18 |
| Monthly rainfall . . . . . . . . . . . . . . . | 3.94 |

## METEOROLOGICAL RECORD FOR APRIL, 1879.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 28.97 | 29°.5 | 77 | 29.03 | 37°.5 | 76 | 29.11 | 43° | 51 | 44°.5 | 30°.5 | 14° | 37°.5 | .00 |
| 2 | 29.40 | 38 | 64 | 29.43 | 41 | 56 | 29.47 | 36.5 | 54 | 42 | 28.5 | 13.5 | 35 | .00 |
| 3 | 29.53 | 30 | 67 | 29.51 | 44 | 59 | 29.38 | 36 | 81 | 47.5 | 24 | 23.5 | 35.7 | .19 |
| 4 | 29.49 | 26 | 75 | 29.53 | 28 | 43 | 29.63 | 27 | 57 | 30 | 23 | 7 | 26.5 | .00 |
| 5 | 29.84 | 25.5 | 69 | 29.89 | 35.5 | 54 | 29.89 | 35 | 54 | 37 | 27 | 10 | 32 | .00 |
| 6 | 30.01 | 31.5 | 58 | 30.00 | 41.5 | 49 | 29.97 | 42 | 45 | 45.5 | 32.5 | 13 | 39 | .00 |
| 7 | 29.89 | 39 | 72 | 29.81 | 49 | 64 | 29.79 | 46 | 51 | 50.5 | 30.5 | 20 | 40.5 | .00 |
| 8 | 29.94 | 35.5 | 58 | 30.03 | 42 | 50 | 30.04 | 43 | 39 | 46 | 36.5 | 9.5 | 41.2 | .00 |
| 9 | 30.05 | 41.5 | 57 | 29.93 | 57 | 46 | 29.89 | 57 | 45 | 59 | 37 | 22 | 48 | .00 |
| 10 | 29.98 | 37 | 67 | 29.94 | 38 | 68 | 29.79 | 34 | 100 | 40 | 31 | 9 | 35.5 | 1.38 |
| 11 | 29.47 | 32 | 79 | 29.57 | 39.5 | 73 | 29.64 | 38 | 76 | 40.5 | 31.5 | 9 | 36 | .01 |
| 12 | 29.77 | 32.5 | 65 | 29.79 | 41 | 38 | 29.83 | 38.5 | 44 | 43.5 | 30 | 13.5 | 36.7 | .00 |
| 13 | 29.95 | 38 | 55 | 29.93 | 47 | 51 | 29.86 | 46 | 51 | 48 | 38 | 10 | 43 | .00 |
| 14 | 29.75 | 43.5 | 78 | 29.72 | 53.5 | 43 | 29.73 | 49.5 | 35 | 54 | 34.5 | 19.5 | 44.2 | .00 |
| 15 | 29.82 | 41 | 66 | 29.84 | 44 | 68 | 29.80 | 38.5 | 86 | 44.5 | 37.5 | 7 | 41 | .28 |
| 16 | 29.77 | 38.5 | 86 | 29.81 | 50 | 45 | 29.89 | 48 | 63 | 53 | 37.5 | 15.5 | 45.2 | .04 |
| 17 | 29.98 | 37.5 | 81 | 30.01 | 40.5 | 77 | 29.96 | 40 | 77 | 44 | 37 | 7 | 40.5 | .59 |
| 18 | 29.77 | 37.5 | 86 | 29.56 | 38 | 95 | 29.40 | 36 | 95 | 40 | 30 | 10 | 35 | 2.23 |
| 19 | 29.43 | 30 | 95 | 29.53 | 32 | 89 | 29.60 | 34.5 | 85 | 39 | 30.5 | 8.5 | 34.7 | .04 |
| 20 | 29.74 | 38 | 68 | 29.83 | 49.5 | 41 | 29.89 | 49.5 | 35 | 53 | 40 | 13 | 46.5 | .00 |
| 21 | 30.07 | 46 | 47 | 30.11 | 56 | 24 | 30.11 | 55 | 28 | 58 | 42 | 16 | 50 | .00 |
| 22 | 30.26 | 46.5 | 61 | 30.29 | 58 | 64 | 30.29 | 58.5 | 64 | 60.5 | 46 | 14.5 | 53.2 | .00 |
| 23 | 30.03 | 53 | 80 | 29.97 | 57.5 | 82 | 29.96 | 56 | 81 | 58.5 | 37 | 21.5 | 47.7 | .00 |
| 24 | 30.30 | 43 | 78 | 30.30 | 52 | 80 | 30.25 | 53 | 80 | 56.5 | 42 | 14.5 | 49.2 | .00 |
| 25 | 30.25 | 46.5 | 88 | 30.23 | 45 | 53 | 30.13 | 47 | 48 | 48 | 39 | 9 | 43.5 | .19 |
| 26 | 30.04 | 39 | 82 | 30.13 | 41.5 | 78 | 30.15 | 43 | 78 | 47 | 38.5 | 8.5 | 42.7 | .00 |
| 27 | 30.25 | 45.5 | 84 | 30.25 | 46.5 | 76 | 30.23 | 53 | 61 | 54.5 | 45.5 | 9 | 50 | .00 |
| 28 | 30.17 | 46.5 | 76 | 30.12 | 56 | 75 | 30.04 | 59.5 | 76 | 63.5 | 42.5 | 21 | 53 | .47 |
| 29 | 30.04 | 53 | 93 | 30.03 | 65 | 94 | 30.01 | 51 | 96 | 68.5 | 48.5 | 20 | 58.5 | .59 |
| 30 | 29.82 | 49 | 100 | 29.67 | 54 | 93 | 29.68 | 59.5 | 76 | 60.5 | 48.5 | 12 | 54.5 | .34 |

Monthly range . . . . . . . . . . . . . . . . 45°.5
Monthly mean . . . . . . . . . . . . . . . . 42°.22
Monthly rainfall . . . . . . . . . . . . . . . 6.35

## METEOROLOGICAL RECORD FOR MAY, 1879.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.67 | 51° | 73 | 29.66 | 59° | 46 | 29.70 | 55°.5 | 48 | 61° | 38° | 23° | 49°.5 | .00 |
| 2 | 29.87 | 46 | 72 | 29.86 | 49 | 63 | 29.82 | 49 | 71 | 51 | 41.5 | 9.5 | 46.2 | .00 |
| 3 | 29.89 | 44 | 56 | 29.90 | 52.5 | 51 | 29.91 | 51.5 | 50 | 53.5 | 39 | 14.5 | 46.2 | .00 |
| 4 | 29.97 | 50.5 | 59 | 29.91 | 61 | 50 | 29.85 | 52 | 60 | 65 | 50 | 15 | 57.5 | .00 |
| 5 | 29.71 | 56.5 | 84 | 29.73 | 68 | 47 | 29.73 | 64 | 57 | 71.5 | 52.5 | 19 | 62 | .02 |
| 6 | 29.87 | 62 | 66 | 29.89 | 63 | 61 | 29.89 | 64 | 55 | 61.5 | 44 | 21.5 | 54.7 | .00 |
| 7 | 30.03 | 50.5 | 48 | 30.04 | 60 | 39 | 30.09 | 61 | 35 | 63 | 45.5 | 17.5 | 54.2 | .00 |
| 8 | 30.25 | 52.5 | 66 | 30.28 | 56.5 | 58 | 30.31 | 54 | 55 | 60 | 44 | 16 | 52 | .00 |
| 9 | 30.48 | 53 | 61 | 30.52 | 57.5 | 46 | 30.52 | 53.5 | 37 | 60 | 40.5 | 19.5 | 50.2 | .00 |
| 10 | 30.53 | 52 | 73 | 30.52 | 53.5 | 61 | 30.47 | 53 | 61 | 55.5 | 44 | 11.5 | 99.5 | .00 |
| 11 | 30.42 | 52 | 66 | 30.39 | 54 | 46 | 30.33 | 57.5 | 55 | 59.5 | 52 | 7.5 | 55.7 | .00 |
| 12 | 30.25 | 55.5 | 78 | 30.19 | 74.5 | 53 | 30.15 | 73 | 58 | 77.5 | 56 | 21.5 | 66.7 | .00 |
| 13 | 30.14 | 66 | 78 | 30.10 | 79 | 60 | 30.07 | 78.5 | 54 | 81 | 60.5 | 20.5 | 70.7 | .00 |
| 14 | 30.06 | 69.5 | 77 | 30.01 | 81 | 45 | 29.99 | 71 | 73 | 81.5 | 57.5 | 24 | 69.5 | .00 |
| 15 | 30.04 | 65.5 | 81 | 30.01 | 76 | 73 | 30.00 | 68 | 79 | 75 | 54.5 | 20.5 | 64.7 | .04 |
| 16 | 30.01 | 55 | 97 | 29.93 | 61 | 88 | 29.89 | 63.5 | 94 | 65 | 55.5 | 9.5 | 60.2 | .03 |
| 17 | 30.07 | 65 | 83 | 30.08 | 69 | 84 | 30.07 | 67.5 | 87 | 73.5 | 60.5 | 13 | 67 | .00 |
| 18 | 30.14 | 63.5 | 91 | 30.13 | 68 | 92 | 30.10 | 68 | 92 | 74.5 | 62 | 12.5 | 68.2 | .02 |
| 19 | 30.09 | 57.5 | 93 | 29.98 | 64 | 100 | 29.97 | 62 | 97 | 66 | 57.5 | 8.5 | 61.7 | .91 |
| 20 | 29.98 | 63 | 94 | 29.96 | 66.5 | 92 | 29.89 | 69 | 89 | 71.5 | 62 | 9.5 | 66.7 | .03 |
| 21 | 29.75 | 69 | 89 | 29.68 | 78 | 80 | 29.77 | 70 | 75 | 79.5 | 48 | 31.5 | 63.7 | .01 |
| 22 | 30.07 | 52.5 | 80 | 30.11 | 53 | 80 | 30.13 | 51 | 89 | 55 | 45 | 10 | 50 | .00 |
| 23 | 30.36 | 47 | 85 | 30.42 | 51 | 76 | 30.43 | 48.5 | 77 | 51.5 | 42.5 | 9 | 47 | .00 |
| 24 | 30.31 | 51.5 | 76 | 30.21 | 51 | 82 | 30.12 | 50.5 | 82 | 58.5 | 47 | 11.5 | 52.7 | .00 |
| 25 | 29.92 | 54.5 | 80 | 29.86 | 61.5 | 72 | 29.78 | 55.5 | 81 | 65 | 50 | 15 | 57.5 | .00 |
| 26 | 29.86 | 52.5 | 77 | 29.92 | 57.5 | 69 | 30.01 | 57 | 69 | 59 | 42.5 | 16.5 | 50.7 | .00 |
| 27 | 30.28 | 54 | 71 | 30.25 | 59.5 | 73 | 30.20 | 59 | 71 | 66.5 | 49.5 | 17 | 53 | .05 |
| 28 | 30.10 | 53.5 | 86 | 30.10 | 64 | 78 | 30.12 | 63 | 77 | 64.5 | 54 | 10.5 | 59.2 | .00 |
| 29 | 30.20 | 63 | 83 | 30.20 | 70 | 75 | 30.17 | 68.5 | 77 | 73 | 54 | 19 | 63.5 | .00 |
| 30 | 30.19 | 65.5 | 81 | 30.13 | 76 | 71 | 30.10 | 70.5 | 77 | 76 | 54 | 22 | 65 | .00 |
| 31 | 30.05 | 69 | 89 | 30.01 | 83 | 60 | 29.98 | 83 | 66 | 86 | 66 | 20 | 76 | .00 |

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|---|---|---|---|
| Monthly range . . . . . . . . . . . . . . . . | 48° | | |
| Monthly mean . . . . . . . . . . . . . . . | | 58°.63 | |
| Monthly rainfall . . . . . . . . . . . . . . . | | | 1.11 |

## METEOROLOGICAL RECORD FOR JUNE, 1879.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.01 | 78·5 | 71 | 29.97 | 88° | 46 | 29.94 | 89° | 48 | 91°.5 | 68° | 23°.5 | 79°7 | .00 |
| 2 | 29.91 | 77 | 69 | 29.91 | 82 | 55 | 29.96 | 75 | 79 | 85.5 | 50.5 | 35 | 68 | .25 |
| 3 | 30.07 | 51 | 93 | 30.11 | 52 | 93 | 30.10 | 50 | 96 | 53 | 48 | 5 | 50.5 | 1.01 |
| 4 | 30.04 | 53.5 | 100 | 29.93 | 60.5 | 94 | 29.87 | 61.5 | 91 | 65 | 54 | 11 | 59.5 | .51 |
| 5 | 29.89 | 62.5 | 80 | 29.83 | 75.5 | 66 | 29.81 | 71.5 | 85 | 71 | 61 | 10 | 66 | .05 |
| 6 | 29.87 | 66 | 76 | 29.78 | 67.5 | 76 | 29.67 | 62.5 | 88 | 71 | 44 | 27 | 55.5 | .14 |
| 7 | 29.97 | 48.5 | 74 | 29.99 | 57 | 64 | 29.97 | 55 | 68 | 61 | 43 | 18 | 52 | .03 |
| 8 | 30.13 | 52.5 | 66 | 30.05 | 62.5 | 67 | 29.98 | 69 | 65 | 68.5 | 46 | 22.5 | 57.2 | .00 |
| 9 | 30.07 | 54 | 80 | 30.03 | 59.5 | 79 | 29.98 | 61 | 85 | 63.5 | 54 | 9.5 | 58.2 | .02 |
| 10 | 29.99 | 58 | 94 | 29.89 | 74 | 72 | 29.87 | 58 | 84 | 74.5 | 52 | 22.5 | 63.2 | .02 |
| 11 | 29.93 | 54 | 86 | 29.97 | 58.5 | 79 | 29.95 | 55 | 87 | 64 | 53 | 11 | 58.5 | .01 |
| 12 | 29.92 | 55 | 93 | 29.88 | 59.5 | 82 | 29.77 | 57 | 90 | 65 | 53 | 12 | 59 | .01 |
| 13 | 29.75 | 65 | 78 | 29.76 | 66.5 | 68 | 29.76 | 72 | 42 | 73 | 53 | 20 | 63 | .00 |
| 14 | 29.88 | 60.5 | 60 | 29.84 | 73 | 76 | 29.77 | 75 | 86 | 76.5 | 61 | 15.5 | 68.7 | .15 |
| 15 | 29.69 | 60 | 88 | 29.65 | 58.5 | 90 | 29.56 | 52 | 97 | 62.5 | 48 | 14.5 | 55.2 | 1.19 |
| 16 | 29.53 | 52 | 100 | 29.55 | 51 | 93 | 29.67 | 52 | 86 | 60 | 49.5 | 10.5 | 54.7 | .02 |
| 17 | 29.83 | 56.5 | 69 | 29.86 | 63.5 | 47 | 29.90 | 62 | 51 | 65.5 | 48 | 17.5 | 56.7 | .00 |
| 18 | 30.04 | 55.5 | 59 | 30.09 | 59 | 62 | 30.13 | 61 | 58 | 62 | 48.5 | 13.5 | 55.2 | .00 |
| 19 | 30.27 | 56 | 75 | 30.29 | 58 | 69 | 30.28 | 58.5 | 61 | 62 | 47.5 | 14.5 | 54.7 | .00 |
| 20 | 30.26 | 60 | 66 | 30.24 | 65 | 63 | 30.22 | 68 | 64 | 68.5 | 54.5 | 14 | 61.5 | .00 |
| 21 | 30.24 | 63.5 | 78 | 30.20 | 74.5 | 56 | 30.18 | 70.5 | 62 | 76 | 58 | 18 | 67 | .00 |
| 22 | 30.15 | 66.5 | 72 | 30.09 | 77.5 | 53 | 30.07 | 72.5 | 72 | 77 | 60 | 17 | 68.5 | .00 |
| 23 | 30.00 | 70 | 75 | 30.02 | 78 | 69 | 30.02 | 82 | 49 | 82.5 | 64 | 18.5 | 73.2 | .00 |
| 24 | 30.19 | 69 | 72 | 30.23 | 69 | 75 | 30.23 | 70 | 68 | 74 | 62.5 | 11.5 | 68.2 | .00 |
| 25 | 30.27 | 70 | 79 | 30.25 | 72 | 60 | 30.20 | 69.5 | 66 | 75 | 62.5 | 12.5 | 68.7 | .01 |
| 26 | 30.18 | 71 | 78 | 30.12 | 73 | 81 | 30.04 | 77.5 | 73 | 77 | 65.5 | 11.5 | 71.2 | .17 |
| 27 | 30.01 | 75 | 83 | 29.94 | 84 | 67 | 29.87 | 84 | 64 | 87.5 | 69 | 18.5 | 78.2 | .00 |
| 28 | 29.81 | 75.5 | 79 | 29.76 | 86 | 58 | 29.68 | 81 | 71 | 87.5 | 70 | 17.5 | 78.7 | .09 |
| 29 | 29.74 | 7 .5 | 85 | 29.71 | 78 | 78 | 29.73 | 61 | 100 | 79.5 | 61 | 18.5 | 70.2 | 2.89 |
| 30 | 29.89 | 66 | 74 | 29.93 | 75 | 44 | 30.00 | 73 | 54 | 75 | 55 | 20 | 65 | .00 |

| | |
|---|---|
| Monthly range . . . . . . . . . . . . . . . . | 48°.5 |
| Monthly mean . . . . . . . . . . . . . . . . | 63°.64 |
| Monthly rainfall . . . . . . . . . . . . . . . | 6.57 |

## METEOROLOGICAL RECORD FOR JULY, 1879.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.32 | 63° | 62 | 30.22 | 68° | 47 | 30.23 | 64° | 67 | 69° .5 | 56° | 13° .5 | 62° .7 | .00 |
| 2 | 30.25 | 68 | 64 | 30.19 | 78 | 52 | 30.11 | 81 | 50 | 82 | 66 | 16 | 74 | .00 |
| 3 | 30.06 | 76 | 69 | 29.99 | 86.5 | 51 | 29.95 | 85 | 61 | 88.5 | 72.5 | 16 | 80.5 | .00 |
| 4 | 29.89 | 79.5 | 72 | 29.81 | 87 | 51 | 29.83 | 75.5 | 83 | 89 | 59 | 30 | 74 | .12 |
| 5 | 30.19 | 61 | 61 | 30.25 | 61 | 55 | 30.26 | 61.5 | 58 | 63 | 51 | 12 | 57 | .00 |
| 6 | 30.28 | 61 | 63 | 30.27 | 65.5 | 61 | 30.23 | 68.5 | 60 | 70 | 57 | 13 | 63.5 | .02 |
| 7 | 30.23 | 61 | 77 | 30.21 | 66 | 78 | 30.15 | 62.5 | 94 | 68 | 61 | 7 | 64.5 | .34 |
| 8 | 29.96 | 63.5 | 97 | 29.80 | 63.5 | 94 | 29.69 | 68.5 | 92 | 71 | 62.5 | 8.5 | 66.7 | .47 |
| 9 | 29.73 | 71 | 64 | 29.75 | 77 | 49 | 29.75 | 78.5 | 53 | 79 | 64 | 15 | 71.5 | .00 |
| 10 | 29.74 | 69 | 72 | 29.74 | 79 | 54 | 29.72 | 77 | 65 | 80 | 65 | 15 | 72.5 | .00 |
| 11 | 29.73 | 72 | 67 | 29.73 | 74 | 61 | 29.66 | 68.5 | 72 | 75 | 62.5 | 12.5 | 68.7 | .02 |
| 12 | 29.70 | 70 | 64 | 29.78 | 74 | 51 | 29.85 | 70 | 57 | 73.5 | 57 | 16.5 | 65.2 | .00 |
| 13 | 29.97 | 69.5 | 92 | 29.99 | 74.5 | 49 | 29.98 | 75 | 64 | 76 | 64 | 12 | 70 | .00 |
| 14 | 29.99 | 71.5 | 60 | 29.98 | 78 | 63 | 29.92 | 84.5 | 55 | 81 | 68.5 | 12.5 | 74.7 | .00 |
| 15 | 29.95 | 77 | 73 | 29.96 | 76 | 69 | 29.89 | 75 | 73 | 79.5 | 71 | 8.5 | 75.2 | .00 |
| 16 | 29.83 | 78.5 | 71 | 29.81 | 87 | 51 | 29.76 | 70 | 90 | 88.5 | 67 | 21.5 | 77.7 | .44 |
| 17 | 29.69 | 71 | 64 | 29.70 | 76 | 64 | 29.74 | 75 | 48 | 77 | 60 | 17 | 68.5 | .00 |
| 18 | 29.97 | 62.5 | 70 | 30.01 | 63 | 67 | 30.02 | 62 | 77 | 65 | 58.5 | 6.5 | 61.7 | .42 |
| 19 | 30.14 | 60.5 | 83 | 30.19 | 64 | 73 | 30.22 | 63 | 74 | 65.5 | 53 | 12.5 | 59.2 | .00 |
| 20 | 30.30 | 64 | 83 | 30.29 | 67 | 64 | 30.29 | 67.5 | 62 | 72 | 58 | 14 | 65 | .00 |
| 21 | 30.30 | 67 | 68 | 30.23 | 69 | 60 | 30.18 | 70.5 | 69 | 75 | 63.5 | 11.5 | 69.2 | .01 |
| 22 | 30.07 | 70 | 75 | 30.02 | 79 | 65 | 30.07 | 77 | 69 | 82 | 66 | 16 | 74 | .21 |
| 23 | 29.88 | 71 | 85 | 29.82 | 72 | 85 | 29.74 | 71.5 | 88 | 74 | 65 | 9 | 69.5 | .01 |
| 24 | 29.89 | 68 | 72 | 29.95 | 70.5 | 71 | 29.97 | 70 | 61 | 73 | 55.5 | 17.5 | 64.2 | .00 |
| 25 | 30.15 | 65 | 56 | 30.16 | 66 | 55 | 30.15 | 66 | 63 | 79 | 63.5 | 15.5 | 71.2 | .00 |
| 26 | 30.08 | 64 | 86 | 30.04 | 63 | 88 | 29.88 | 61 | 100 | 65.5 | 60 | 5.5 | 62.7 | 1.07 |
| 27 | 29.77 | 62 | 94 | 30.79 | 78.5 | 70 | 29.93 | 81 | 63 | 82 | 63 | 19 | 72.5 | .00 |
| 28 | 29.95 | 73 | 65 | 29.97 | 73 | 70 | 29.96 | 68 | 79 | 82 | 62 | 20 | 72 | .00 |
| 29 | 29.98 | 70.5 | 78 | 29.96 | 77.5 | 73 | 29.95 | 79 | 70 | 80 | 66.5 | 13.5 | 73.2 | .00 |
| 30 | 30.02 | 74 | 81 | 30.02 | 83 | 63 | 30.02 | 78 | 75 | 84 | 67 | 17 | 75.5 | .00 |
| 31 | 30.15 | 71.5 | 73 | 30.19 | 75 | 60 | 30.17 | 74 | 72 | 77 | 63.5 | 13.5 | 70.2 | .00 |

| | |
|---|---|
| Monthly range . . . . . . . . . . . . . . . . | 38° |
| Monthly mean . . . . . . . . . . . . . . . | 69° .28 |
| Monthly rainfall . . . . . . . . . . . . . . | 3.13 |

## METEOROLOGICAL RECORD FOR AUGUST, 1879.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.17 | 73°.5 | 79 | 30.13 | 80° | 66 | 30.10 | 80° | 70 | 81° | 68°5 | 12°5 | 74°.7 | .00 |
| 2 | 30.08 | 77 | 73 | 30.07 | 87.5 | 48 | 29.99 | 87 | 51 | 91 | 79 | 12 | 85 | .00 |
| 3 | 29.97 | 78 | 70 | 29.95 | 87 | 50 | 29.92 | 83.5 | 66 | 88 | 67.5 | 20.5 | 77.7 | .00 |
| 4 | 29.95 | 74 | 68 | 29.95 | 76 | 62 | 29.93 | 73.5 | 50 | 79 | 66.5 | 12.5 | 72.7 | .00 |
| 5 | 29.90 | 73.5 | 74 | 29.88 | 77 | 73 | 29.84 | 80 | 68 | 82 | 70.5 | 11.5 | 76.2 | .13 |
| 6 | 29.81 | 77 | 75 | 29.79 | 82 | 39 | 29.76 | 82 | 45 | 84 | 57.5 | 26.5 | 70.7 | .00 |
| 7 | 29.92 | 62 | 56 | 29.91 | 73 | 56 | 29.88 | 71 | 57 | 77 | 62 | 15 | 67.5 | .02 |
| 8 | 29.84 | 64.5 | 86 | 29.83 | 66.5 | 76 | 29.82 | 62 | 88 | 67 | 59 | 8 | 63 | .02 |
| 9 | 29.83 | 63 | 83 | 29.90 | 68 | 79 | 29.93 | 65.5 | 81 | 69.5 | 55.5 | 14 | 62.5 | .00 |
| 10 | 29.97 | 61 | 63 | 29.99 | 67 | 57 | 30.03 | 66 | 63 | 68.5 | 52.5 | 16 | 60.5 | .00 |
| 11 | 30.05 | 62 | 72 | 30.08 | 68.5 | 51 | 30.09 | 67.5 | 74 | 70.5 | 56.5 | 14 | 63.5 | .00 |
| 12 | 30.17 | 66 | 81 | 30.17 | 72.5 | 67 | 30.11 | 74 | 72 | 74 | 61.5 | 12.5 | 67.7 | .00 |
| 13 | 30.11 | 69 | 79 | 30.05 | 80 | 54 | 30.00 | 78 | 57 | 83 | 65.5 | 17.5 | 74.2 | .00 |
| 14 | 29.87 | 72 | 76 | 29.78 | 81 | 63 | 29.75 | 74.5 | 72 | 83 | 60.5 | 23.5 | 71.7 | .00 |
| 15 | 30.01 | 63 | 74 | 30.07 | 63.5 | 67 | 30.11 | 63 | 69 | 67 | 63 | 4 | 65 | .02 |
| 16 | 30.21 | 59 | 91 | 30.17 | 57 | 87 | 30.06 | 55.5 | 90 | 64 | 55 | 9 | 59.5 | 1.21 |
| 17 | 29.98 | 56 | 90 | 30.01 | 58 | 93 | 30.03 | 56.5 | 100 | 58.5 | 55.5 | 3 | 57 | .19 |
| 18 | 30.05 | 58.5 | 100 | 30.01 | 61 | 94 | 29.91 | 58 | 100 | 63.5 | 57.5 | 6 | 60.5 | 7.20 |
| 19 | 29.72 | 63 | 83 | 29.84 | 72 | 63 | 29.97 | 69 | 65 | 73 | 52 | 21 | 67.5 | .00 |
| 20 | 30.16 | 60 | 68 | 30.13 | 71 | 45 | 29.11 | 73 | 53 | 74 | 58 | 16 | 66 | .00 |
| 21 | 30.13 | 66.5 | 81 | 30.09 | 73.5 | 74 | 30.01 | 75 | 68 | 76 | 58 | 18 | 67 | .00 |
| 22 | 29.91 | 69 | 87 | 29.85 | 80 | 66 | 29.78 | 81 | 71 | 83.5 | 70 | 13.5 | 76.7 | .00 |
| 23 | 29.69 | 74 | 81 | 29.69 | 81 | 58 | 29.70 | 78 | 69 | 81.5 | 61.5 | 20 | 71.5 | .00 |
| 24 | 29.78 | 73 | 74 | 29.74 | 81 | 58 | 29.74 | 76.5 | 77 | 81 | 61 | 20 | 71 | .00 |
| 25 | 29.79 | 65 | 78 | 29.82 | 68 | 72 | 29.86 | 64 | 89 | 71.5 | 59 | 12.5 | 65.2 | .20 |
| 26 | 29.94 | 59 | 88 | 29.98 | 59.5 | 76 | 30.00 | 58.5 | 82 | 61.5 | 54.5 | 7 | 58 | .00 |
| 27 | 30.03 | 60 | 79 | 30.06 | 60.5 | 85 | 30.06 | 59.5 | 85 | 62.5 | 52 | 10.5 | 57.2 | .01 |
| 28 | 30.10 | 59 | 85 | 30.12 | 63.5 | 70 | 30.11 | 59 | 79 | 64 | 51.5 | 12.5 | 57.7 | .00 |
| 29 | 30.07 | 61 | 71 | 30.02 | 68 | 74 | 29.93 | 71 | 80 | 71 | 56.5 | 14.5 | 63.7 | .32 |
| 30 | 29.97 | 62 | 77 | 30.01 | 67 | 79 | 29.97 | 66 | 84 | 67 | 56.5 | 10.5 | 61.7 | .00 |
| 31 | 29.99 | 63.5 | 75 | 29.97 | 74 | 49 | 29.96 | 73 | 63 | 76.5 | 57.5 | 19 | 67 | .00 |

Monthly range . . . . . . . . . . . . . . . . 39°.5

Monthly mean . . . . . . . . . . . . . . . . 67°.02

Monthly rainfall . . . . . . . . . . . . . . . . 9.32

## METEOROLOGICAL RECORD FOR SEPTEMBER, 1879.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.98 | 67°.5 | 76 | 29.98 | 73°5 | 72 | 29.92 | 75° | 83 | 78°5 | 66° | 12°5 | 72°2 | .00 |
| 2 | 29.97 | 71.5 | 85 | 29.99 | 82 | 72 | 29.99 | 78.5 | 80 | 84 | 66 | 18 | 75 | .01 |
| 3 | 30.06 | 66.5 | 87 | 30.06 | 72 | 80 | 30.02 | 65 | 94 | 74 | 61.5 | 13 | 68 | .79 |
| 4 | 29.89 | 61.5 | 100 | 29.83 | 63 | 100 | 29.86 | 64 | 100 | 65 | 57 | 8 | 61 | .03 |
| 5 | 29.96 | 60 | 94 | 29.96 | 71 | 57 | 29.98 | 66 | 68 | 71.5 | 50 | 21.5 | 60.7 | .00 |
| 6 | 30.11 | 54.5 | 81 | 30.11 | 65.5 | 68 | 30.10 | 61.5 | 80 | 65.5 | 55 | 10.5 | 60.2 | .00 |
| 7 | 30.07 | 63 | 88 | 30.04 | 72.5 | 76 | 30.03 | 68.5 | 92 | 73.5 | 63.5 | 10 | 68.5 | .27 |
| 8 | 29.84 | 67 | 94 | 29.80 | 73 | 76 | 29.77 | 74 | 61 | 75 | 52 | 23 | 63.5 | .15 |
| 9 | 29.91 | 59 | 70 | 29.95 | 67.5 | 57 | 30.01 | 65 | 67 | 68 | 53 | 15 | 60.5 | .00 |
| 10 | 30.20 | 57.5 | 75 | 30.25 | 64.5 | 63 | 30.28 | 62 | 74 | 66 | 51 | 15 | 58.5 | .00 |
| 11 | 30.36 | 55 | 87 | 30.38 | 64.5 | 75 | 30.36 | 61 | 83 | 66 | 49.5 | 16.5 | 57.7 | .00 |
| 12 | 30.31 | 56 | 84 | 30.26 | 66.5 | 71 | 30.21 | 63 | 74 | 67 | 49.5 | 17.5 | 58.2 | .00 |
| 13 | 30.15 | 61.5 | 80 | 30.13 | 67 | 62 | 30.11 | 64 | 65 | 69 | 59 | 10 | 64 | .14 |
| 14 | 30.07 | 63.5 | 91 | 29.97 | 66 | 89 | 29.95 | 62.5 | 91 | 68 | 52 | 16 | 60 | .12 |
| 15 | 30.13 | 57 | 75 | 30.19 | 64 | 70 | 30.18 | 61 | 80 | 67 | 54 | 13 | 60.5 | .00 |
| 16 | 30.09 | 60 | 85 | 30.01 | 59 | 87 | 29.92 | 57.5 | 100 | 63 | 56.5 | 6.5 | 59.7 | .03 |
| 17 | 29.83 | 62 | 94 | 29.79 | 67.5 | 53 | 29.92 | 65 | 54 | 71.5 | 48 | 23.5 | 59.7 | .00 |
| 18 | 30.15 | 55.5 | 75 | 30.16 | 68 | 55 | 30.14 | 63 | 74 | 69 | 55.5 | 13.5 | 62.2 | .03 |
| 19 | 30.16 | 58 | 87 | 30.20 | 64 | 53 | 30.22 | 58 | 82 | 70 | 46 | 24 | 58 | .03 |
| 20 | 30.27 | 51.5 | 86 | 30.28 | 63 | 57 | 30.28 | 59 | 76 | 63.5 | 44.5 | 19 | 54 | .00 |
| 21 | 30.42 | 47 | 92 | 30.44 | 58 | 67 | 30.45 | 55.5 | 78 | 60 | 48 | 12 | 54 | .00 |
| 22 | 30.40 | 55 | 81 | 30.35 | 57 | 69 | 30.24 | 54 | 83 | 58.5 | 52.5 | 6 | 55.5 | .00 |
| 23 | 30.10 | 54 | 86 | 30.06 | 60.5 | 79 | 30.01 | 61 | 88 | 62.5 | 54 | 8.5 | 58.2 | .00 |
| 24 | 29.94 | 58 | 97 | 29.78 | 72.5 | 69 | 29.87 | 55 | 93 | 72.5 | 41 | 31.5 | 56.7 | .22 |
| 25 | 30.15 | 41.5 | 62 | 30.15 | 51 | 46 | 30.24 | 48.5 | 67 | 53.5 | 36.5 | 17 | 45 | .00 |
| 26 | 30.41 | 42.5 | 78 | 30.44 | 53.5 | 58 | 30.43 | 51 | 65 | 54.5 | 40 | 14.5 | 47.2 | .00 |
| 27 | 30.47 | 46.5 | 92 | 29.46 | 55 | 59 | 30.41 | 53.5 | 83 | 56.5 | 42 | 14.5 | 49.2 | .00 |
| 28 | 30.42 | 50.5 | 86 | 30.37 | 62 | 69 | 30.35 | 57.5 | 90 | 63 | 51 | 12 | 57 | .00 |
| 29 | 30.35 | 57 | 93 | 30.31 | 69.5 | 70 | 30.28 | 65 | 78 | 71.5 | 56 | 15.5 | 63.7 | .00 |
| 30 | 20.25 | 59 | 94 | 30.21 | 78 | 57 | 30.20 | 73 | 72 | 79 | 58 | 21 | 68.5 | .00 |

| | | | |
|---|---|---|---|
| Monthly range . . . . . . . . . . . . . . . . . | 47°.5 | | |
| Monthly mean . . . . . . . . . . . . . . . . . | | 59°.92 | |
| Monthly rainfall . . . . . . . . . . . . . . . . | | | 1.82 |

## METEOROLOGICAL RECORD FOR OCTOBER, 1879.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.18 | 67° | 68 | 30.13 | 80°5 | 50 | 30.11 | 77° | 67 | 83° | 62° | 21° | 72°.5 | .00 |
| 2 | 30.29 | 65 | 87 | 30.28 | 71 | 62 | 30.27 | 60 | 85 | 72.5 | 57 | 15.5 | 64.7 | .00 |
| 3 | 30.03 | 66 | 81 | 29.91 | 78.5 | 56 | 29.93 | 72 | 52 | 80 | 51 | 29 | 65.5 | .00 |
| 4 | 30.11 | 56 | 57 | 30.13 | 66 | 45 | 30.12 | 62 | 66 | 70 | 51 | 19 | 60.5 | .00 |
| 5 | 30.09 | 55 | 78 | 30.04 | 67.5 | 53 | 30.01 | 68 | 62 | 75 | 39 | 36 | 57 | .00 |
| 6 | 30.29 | 53 | 83 | 30.36 | 54 | 80 | 30.38 | 53.5 | 77 | 55 | 52.5 | 2.5 | 53.7 | .00 |
| 7 | 30.40 | 54 | 80 | 30.31 | 68 | 62 | 30.26 | 68 | 69 | 72 | 59 | 13 | 65.5 | .00 |
| 8 | 30.23 | 66 | 73 | 30.17 | 79.5 | 56 | 30.13 | 76 | 61 | 84.5 | 64.5 | 20 | 74.5 | .00 |
| 9 | 30.11 | 69 | 75 | 30.12 | 74 | 68 | 30.11 | 66 | 81 | 75.5 | 57 | 18.5 | 66.2 | .01 |
| 10 | 30.23 | 57.5 | 100 | 30.25 | 60 | 91 | 30.26 | 57 | 93 | 62 | 51 | 11 | 56.5 | .03 |
| 11 | 30.39 | 51 | 100 | 30.39 | 53 | 83 | 30:37 | 53 | 83 | 55 | 51.5 | 3.5 | 53.2 | .02 |
| 12 | 30.29 | 54 | 97 | 30.22 | 61.5 | 86 | 30.16 | 57 | 87 | 63.5 | 55 | 8.5 | 59.2 | .01 |
| 13 | 30.18 | 60 | 88 | 30.18 | 61 | 77 | 30.14 | 59.5 | 32 | 65 | 44 | 21 | 54.5 | .00 |
| 14 | 30.17 | 48 | 62 | 30.15 | 64 | 25 | 30.13 | 61 | 30 | 67 | 47.5 | 19.5 | 57.2 | .00 |
| 15 | 30.11 | 53 | 54 | 30.05 | 70.5 | 46 | 30.03 | 63.5 | 67 | 73.5 | 53 | 20.5 | 63.2 | .00 |
| 16 | 30.06 | 65.5 | 75 | 30.09 | 76 | 64 | 30.11 | 65 | 81 | 76.5 | 58.5 | 18 | 67.5 | .00 |
| 17 | 30.28 | 58.5 | 84 | 30.29 | 58.5 | 87 | 30.07 | 56.5 | 87 | 60 | 54.5 | 5.5 | 57.2 | .00 |
| 18 | 30.20 | 56 | 87 | 30.10 | 65 | 78 | 30.00 | 61 | 85 | 67.5 | 56.5 | 11 | 62 | .34 |
| 19 | 29.85 | 57.5 | 90 | 29.87 | 55.5 | 59 | 30.00 | 44 | 48 | 60 | 34.5 | 25.5 | 47.2 | .01 |
| 20 | 30.15 | 36 | 67 | 30.15 | 47.5 | 42 | 30.16 | 46.5 | 54 | 50.5 | 36 | 14.5 | 43.2 | .00 |
| 21 | 30.23 | 46 | 73 | 30.20 | 64 | 41 | 30.19 | 58 | 47 | 65.5 | 46 | 19.5 | 55.7 | .01 |
| 22 | 30.25 | 54 | 93 | 30.23 | 63.5 | 75 | 30.20 | 59.5 | 85 | 65 | 55 | 10 | 60 | .03 |
| 23 | 29.98 | 64 | 83 | 29.91 | 68 | 79 | 29.85 | 62 | 86 | 70 | 41.5 | 28.5 | 55.7 | .01 |
| 24 | 29.92 | 41.5 | 62 | 29.97 | 42.5 | 39 | 30.10 | 36 | 54 | 46 | 28 | 18 | 37 | .00 |
| 25 | 30.43 | 30 | 62 | 30.52 | 36 | 32 | 30.59 | 32.5 | 46 | 38.5 | 25.5 | 13 | 32 | .00 |
| 26 | 30.68 | 28.5 | 65 | 30.66 | 41.5 | 57 | 30.60 | 44.5 | 48 | 52.5 | 29.5 | 23 | 41 | .00 |
| 27 | 30.36 | 41 | 74 | 30.26 | 56 | 51 | 30.16 | 51 | 69 | 58 | 38 | 20 | 48 | .00 |
| 28 | 29.90 | 48 | 93 | 29.67 | 52 | 100 | 29.41 | 52.5 | 100 | 56 | 47 | 9 | 51.5 | .25 |
| 29 | 29.29 | 50 | 58 | 29.37 | 57 | 46 | 29.52 | 52 | 60 | 58.5 | 46.5 | 12 | 52.5 | .00 |
| 30 | 29.55 | 49.5 | 64 | 29.54 | 55 | 41 | 29.62 | 49.5 | 54 | 57 | 40 | 17 | 48.5 | .00 |
| 31 | 29.79 | 40.5 | 56 | 29.83 | 47 | 41 | 29.92 | 40.5 | 56 | 48 | 32.5 | 15.5 | 40.2 | .00 |

Monthly range . . . . . . . . . . . . . . . . . 59°
Monthly mean . . . . . . . . . . . . . . . . 55°.60
Monthly rainfall . . . . . . . . . . . . . . . .72

## METEOROLOGICAL RECORD FOR NOVEMBER, 1879.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Minimum Thermometer. | Maximum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.09 | 34° | 70 | 30.12 | 40°.5 | 41 | 30.16 | 35°.5 | 54 | 42°.5 | 28° | 14.5 | 35.2 | .00 |
| 2 | 30.30 | 31 | 68 | 30.27 | 41 | 45 | 30.21 | 39 | 56 | 43 | 32.5 | 10.5 | 37.7 | .00 |
| 3 | 29.99 | 37 | 90 | 29.87 | 37 | 95 | 29.76 | 35 | 90 | 42.5 | 26 | 16.5 | 34.2 | .26 |
| 4 | 30.10 | 26.5 | 82 | 30.11 | 31 | 58 | 30.19 | 30 | 56 | 33 | 19 | 14 | 26 | .00 |
| 5 | 30.36 | 22 | 44 | 30.44 | 33 | 66 | 30.46 | 29 | 77 | 35 | 22 | 13 | 28.5 | .05 |
| 6 | 30.46 | 25 | 87 | 30.40 | 32 | 84 | 30.34 | 32.5 | 89 | 35 | 26 | 9 | 30.5 | .15 |
| 7 | 30.35 | 32.5 | 95 | 30.35 | 37 | 90 | 30.38 | 35 | 85 | 38 | 33 | 5 | 35.5 | .01 |
| 8 | 30.39 | 38 | 90 | 30.37 | 51 | 59 | 30.34 | 48 | 77 | 62.5 | 40 | 12.5 | 46.2 | .00 |
| 9 | 30.33 | 51.5 | 76 | 30.26 | 63.5 | 70 | 30.20 | 58.5 | 76 | 65 | 52 | 13 | 58.5 | .00 |
| 10 | 30.13 | 59 | 70 | 30.16 | 61 | 61 | 30.18 | 51.5 | 63 | 61.5 | 40 | 21.5 | 50.7 | .00 |
| 11 | 30.27 | 40.5 | 69 | 30.27 | 49 | 57 | 30.22 | 45 | 76 | 56 | 41 | 15 | 48.5 | .08 |
| 12 | 29.88 | 56 | 93 | 29.84 | 67 | 74 | 29.83 | 56.5 | 90 | 67.5 | 40 | 27.5 | 53.7 | .37 |
| 13 | 29.92 | 40 | 82 | 30.12 | 44 | 84 | 30.20 | 42 | 95 | 47.5 | 40 | 7.5 | 43.7 | .02 |
| 14 | 30.31 | 46.5 | 85 | 30.21 | 51.5 | 83 | 30.11 | 51 | 82 | 61 | 47 | 14 | 54 | .00 |
| 15 | 29.79 | 56.5 | 97 | 29.62 | 64.5 | 78 | 29.56 | 61.5 | 88 | 67 | 48.5 | 18.5 | 57.7 | .00 |
| 16 | 29.80 | 58.5 | 58 | 29.81 | 56.5 | 51 | 29.93 | 49.5 | 54 | 57.5 | 40.5 | 17 | 49 | .00 |
| 17 | 30.21 | 42 | 70 | 30.33 | 51 | 46 | 30.24 | 46.5 | 58 | 51.5 | 41.5 | 10 | 46.5 | .02 |
| 18 | 30.17 | 42 | 91 | 30.03 | 38 | 100 | 29.90 | 36.5 | 100 | 38.5 | 26.5 | 12 | 32.5 | 1.06 |
| 19 | 30.03 | 28 | 88 | 30.01 | 37 | 63 | 29.97 | 36.5 | 80 | 41.5 | 28 | 13.5 | 34.7 | .14 |
| 20 | 29.46 | 35.5 | 100 | 29.27 | 34 | 100 | 29.29 | 32 | 89 | 36 | 13 | 23 | 24.5 | .19 |
| 21 | 29.60 | 13 | 80 | 29.76 | 16 | 42 | 29.92 | 16 | 56 | 19 | 13 | 6 | 16 | .00 |
| 22 | 30.30 | 15.5 | 74 | 30.35 | 27.5 | 59 | 30.32 | 27.5 | 76 | 40.5 | 17 | 23.5 | 28.7 | .07 |
| 23 | 30.07 | 38.5 | 86 | 29.91 | 42.5 | 70 | 29.88 | 38 | 64 | 44 | 26 | 18 | 35 | .00 |
| 24 | 30.10 | 26 | 51 | 30.21 | 30.5 | 73 | 30.28 | 29 | 66 | 33 | 27.5 | 5.5 | 30.2 | .00 |
| 25 | 30.19 | 32.5 | 75 | 30.03 | 43.5 | 71 | 30.06 | 39 | 64 | 45.5 | 32 | 12.5 | 38.2 | .00 |
| 26 | 30.34 | 32 | 59 | 30.38 | 40 | 44 | 30.42 | 36 | 54 | 41 | 29 | 12 | 35 | .00 |
| 27 | 30.47 | 29.5 | 73 | 30.47 | 39.5 | 69 | 30.44 | 41.5 | 66 | 44 | 32 | 12 | 38 | .00 |
| 28 | 30.25 | 42 | 91 | 30.13 | 50 | 93 | 30.02 | 51 | 86 | 56 | 43 | 13 | 49.5 | .75 |
| 29 | 29.70 | 52 | 100 | 29.64 | 50 | 82 | 29.72 | 39.5 | 60 | 53.5 | 23.5 | 30 | 38.5 | .02 |
| 30 | 30.19 | 22.5 | 52 | 30.26 | 27.5 | 42 | 30.38 | 24.5 | 61 | 29.5 | 21 | 8.5 | 25.2 | .00 |

| | |
|---|---|
| Monthly range . . . . . . . . . . . . . . . . . | 54°.5 |
| Monthly mean . . . . . . . . . . . . . . . . . | 38°.76 |
| Monthly rainfall . . . . . . . . . . . . . . . | 3.79 |

## METEOROLOGICAL RECORD FOR DECEMBER, 1879.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.45 | 22·5 | 79 | 30.37 | 38·5 | 47 | 30·28 | 36·5 | 55 | 40·5 | 23·5 | 17 | 32 | .00 |
| 2 | 30.21 | 34 | 70 | 30.19 | 46 | 61 | 30.17 | 45.5 | 72 | 47.5 | 34.5 | 33 | 41 | .00 |
| 3 | 30.26 | 40 | 82 | 30.18 | 49 | 63 | 30.17 | 43 | 83 | 49 | 37.5 | 11.5 | 43.2 | .16 |
| 4 | 30.14 | 37 | 81 | 30.17 | 53 | 66 | 30.28 | 45 | 76 | 54 | 28.5 | 25.5 | 41.2 | .00 |
| 5 | 30.43 | 29 | 77 | 30.49 | 39 | 72 | 30.48 | 37.5 | 81 | 41 | 29.5 | 11.5 | 35.2 | .00 |
| 6 | 30.40 | 40 | 82 | 30.30 | 41.5 | 91 | 30.14 | 44.5 | 92 | 56 | 41 | 15 | 48.5 | .45 |
| 7 | 29.54 | 54.5 | 83 | 29.70 | 52.5 | 57 | 29.86 | 46 | 61 | 55.5 | 41 | 14.5 | 48.2 | .00 |
| 8 | 30.07 | 41.5 | 83 | 30.15 | 47 | 81 | 30.20 | 45 | 80 | 48.5 | 30.5 | 18 | 39.5 | .01 |
| 9 | 30.44 | 30.5 | 78 | 30.51 | 36.5 | 67 | 30.55 | 32 | 79 | 40 | 31 | 9 | 35.5 | .00 |
| 10 | 30.50 | 40 | 77 | 30.40 | 42.5 | 83 | 30.28 | 45 | 88 | 56 | 41 | 15 | 48.5 | .11 |
| 11 | 29.83 | 56 | 93 | 29.73 | 62 | 88 | 29.81 | 49 | 78 | 62.5 | 38 | 24.5 | 50.2 | .00 |
| 12 | 29.99 | 37 | 72 | 30.09 | 38 | 55 | 30.22 | 32 | 59 | 39 | 21.5 | 17.5 | 30.2 | .00 |
| 13 | 30.47 | 21.5 | 71 | 30.62 | 30 | 67 | 30.67 | 28.5 | 60 | 35 | 23 | 12 | 39 | .00 |
| 14 | 30.67 | 34 | 80 | 30.54 | 38 | 82 | 30.34 | 37.5 | 100 | 42.5 | 35.5 | 7 | 39 | 2.30 |
| 15 | 29.73 | 36.5 | 90 | 29.61 | 40 | 91 | 29.58 | 39.5 | 82 | 43 | 32.5 | 10.5 | 37.7 | .00 |
| 16 | 29.78 | 32.5 | 75 | 29.93 | 36 | 76 | 29.98 | 31 | 79 | 37 | 31 | 6 | 34 | .00 |
| 17 | 29.89 | 33 | 79 | 29.90 | 38.5 | 64 | 29.98 | 31.5 | 64 | 40 | 12 | 28 | 26 | .00 |
| 18 | 30.33 | 12 | 61 | 30.37 | 19.5 | 33 | 30.40 | 20.5 | 49 | 31 | 13 | 18 | 22 | .01 |
| 19 | 30.40 | 27 | 100 | 30.40 | 29 | 88 | 30.39 | 28.5 | 77 | 31 | 26 | 5 | 28.5 | .02 |
| 20 | 30.16 | 27 | 100 | 30.04 | 36 | 71 | 29.98 | 37.5 | 76 | 41 | 3.5 | 37.5 | 22.2 | .00 |
| 21 | 30.29 | 3.5 | 32 | 30.39 | 5.5 | 38 | 30.49 | 4.5 | 36 | 23 | 3 | 20 | 13 | .13 |
| 22 | 30.50 | 23 | 100 | 30.26 | 32.5 | 100 | 30.05 | 10.5 | 80 | 33.5 | 10.5 | 23 | 22 | .34 |
| 23 | 30.28 | 21.5 | 85 | 30.37 | 30 | 83 | 30.45 | 29 | 80 | 37.5 | 21.5 | 16 | 29.5 | .32 |
| 24 | 30.31 | 37.5 | 100 | 30.02 | 38.5 | 100 | 29.98 | 34 | 95 | 40 | 35.5 | 4.5 | 37.7 | .15 |
| 25 | 29.92 | 37.5 | 90 | 29.92 | 31.5 | 64 | 29.91 | 22.5 | 60 | 39.5 | 3 | 36.5 | 21.2 | .03 |
| 26 | 30.01 | 3 | 73 | 30.05 | 13.5 | 21 | 30.08 | 13 | 41 | 18 | 3 | 15 | 10.5 | .00 |
| 27 | 30.25 | 15 | 56 | 30.26 | 23 | 53 | 30.23 | 24 | 68 | 33 | 16.5 | 16.5 | 24.7 | .00 |
| 28 | 30.28 | 31.5 | 64 | 30.26 | 39.5 | 48 | 30.24 | 37 | 67 | 42 | 32 | 10 | 37 | .04 |
| 29 | 30.05 | 37 | 90 | 29.94 | 45 | 76 | 30.91 | 12 | 75 | 45 | 37.5 | 7.5 | 41.2 | .12 |
| 30 | 29.90 | 41 | 87 | 29.98 | 42 | 66 | 30.20 | 27 | 64 | 42 | 8 | 31 | 25 | .00 |
| 31 | 30.66 | 8 | 66 | 30.62 | 14 | 73 | 30.81 | 27 | 100 | 29 | 7 | 22 | 18 | .52 |

| | | | |
|---|---|---|---|
| Monthly range . . . . . . . . . . . . . . . | 59 5 | | |
| Monthly mean . . . . . . . . . . . . . . . | | 32 .61 | |
| Monthly rainfall . . . . . . . . . . . . . . | | | 4.71 |
| Total rainfall for the year . . . . . . . . . | | 46.58 | |

8[illegible]

# NINTH ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD

OF THE

# CITY OF LYNN,

FOR THE YEAR ENDING DEC. 31, 1880.

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1881.

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1881.

# PUBLIC WATER BOARD.

## OFFICERS FOR 1881.

| | |
|---|---|
| EDWIN WALDEN, *President*,<br>For five years. | **THOMAS B. NEWHALL,**<br>**For one year.** |
| DAVID H. SWEETSER,<br>For two years. | **JAMES N. BUFFUM,**<br>**For three years.** |

JAMES PURINTON,
For four years.

| | |
|---|---|
| *Superintendent and Clerk,*<br>DANIEL WALDEN. | *Water Registrar,*<br>SIMON J. RONEY. |
| *Pumping Engineer,*<br>WILLIAM H. MESSINGER. | *Inspector,*<br>CHARLES H. CLIFFORD. |

*Foreman of Pipe Work,*
EDWIN MAXWELL.

# ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD.

---

**Office of the Public Water Board,**
*February 28, 1881.*

The Public Water Board hereby present to the City Council their Ninth Annual Report. Appended will be found the Annual Report of the Superintendent of the Works, and of the Water Registrar, as presented to the Board at the close of the year. To these we refer for important information relating to the department, and ask that the same may be regarded as a part of our own report.

The accounts of the Registrar have been carefully audited by a committee of the Board. Their report shows all the accounts to have been accurately kept, and that all money received has been promptly paid over to the City Treasurer, who has acknowledged receipt of the same.

The commendation heretofore bestowed on the Superintendent, and Registrar, for the fidelity and faithfulness with which their duties have been discharged, is as fully deserved as in previous years. No citizen seeking information in regard to the management of this department, or wanting knowledge of its methods in the conduct of its affairs, can fail to be properly informed upon conference with these intelligent and every way competent officials.

## RECEIPTS.

By reference to the report of the Water Registrar it will be seen that the receipts of the department for the past year, for all purposes, were $81,955.31. Of this amount $2,056.39 were received for extra pipe laid, labor, etc., leaving as the legitimate income of the department, applicable to the expenses of maintenance and interest payments, the sum of $79,898.92. The receipts for the year 1879 were $73,791.47, showing an increase in the income of the department the past year of $6,107.45; or a gain over the receipts of the previous year of more than eight per cent.

The Registrar has been as successful in collecting the water rents as in previous years, there remaining uncollected at the close of the year, less abatements made, the small balance of $77.25.

## MAINTENANCE.

The expenses of the department classed under the head of maintenance were for the past year $10,277.93, showing an increase over the amount of the maintenance account of 1879 of $1,025.55. An examination of the detailed statement of the Registrar will show this increase to have been mainly due to higher prices paid for coal, a somewhat increased repair account, a small increase in office expenses, and a better equipment of stable and workshop.

## CONSTRUCTION.

There was charged to Construction account during the past year $27,397.38. Of this amount $7,389.58 was expended in putting in new services, and small-sized pipe laid in courts as distribution pipe. $13,455.92 was the cost of new mains, hydrants and gates, in extension of the works to streets not heretofore supplied with water. The other large item is the cost of the tubular well experiment, which, under the terms of the order passed by the City Council requiring the test to be made, was made chargeable to Account of Construction. This item, at the close of the year, reached the considerable sum of $6,189.82.

Extensions of the works by the laying of new lines of pipe are always prosecuted under the direction of the Board, but always in pursuance of orders passed by the City Council. Petitions presented to the City Council for extension of the works, and referred to the Committee on Water Supply, are usually referred to this Board for an estimate of cost, an opinion as to the necessity for such extension, and what will be the probable income if granted. If a reasonable deference to the opinions of the Board upon the subject-matter of such petitions be shown, no unnecessary and unprofitable lines of pipe will be laid.

## FINANCIAL STANDING.

For the two years ending with 1880 the water department has required no assistance from the City Treasury for means to meet its current expenses and interest payments. On the contrary, the income from water rents has not only provided for these, but has furnished a handsome sum to the Water Debt Sinking Fund, established for the extinguishment of the water debt, as follows:

| | | |
|---|---|---|
| *Cr.* | | |
| Receipts for 1879 | $73,791 47 | |
| " " 1880 | 79,898 92 | |
| Total income, 1879–80 | | $153,690 39 |
| 1879. *Dr.* | | |
| Maintenance account | $9,252 38 | |
| Interest payments | 51,790 00 | |
| 1880. | | |
| Maintenance account | $10,277 93 | |
| Interest payments | 52,230 00 | |
| Total for interest and maintenance | | $123,550 31 |
| Balance to Sinking Fund | | $30,140 08 |

The receipts and expenses for the past year were as below named:

| | | |
|---|---|---|
| Income of the Department | | $79,898 92 |
| Maintenance account | $10,277 93 | |
| Interest payments | 52,230 00 | |
| Total interest and maintenance | | $62,507 93 |
| Balance to Sinking Fund | | $17,390 99 |

The foregoing statement shows the financial standing of this department at the close of the ninth year in its history. The large and annually increasing income from the sale of water for manufacturing and domestic purposes, is the ready response of the public to the city governments whose wisdom and foresight led them to aid in the construction of the works, and generously to assist the undertaking while it was working its way to a self-sustaining position. The period required for this was not long, nor the outlay costly. The means furnished by the treasury of the city to meet deficiencies in income, for interest payments, and the maintenance account, have always been small, and in their total sum do not equal one-fourth of one per cent. on the city's valuation for one year. For this slight burden the city and the citizens have received abundant renumeration. No appropriations for the constructions of wells, capacious, costly cisterns, for a store of water in case of fire, have been required. In charge of the Fire Department the hydrant service has been, at most fires, as effective as the use of its own equipment. Except as the water department provides these facilities, the outfit of the fire department would need be doubled. Without these aids rates of insurance would be much increased; the success of the firemen in battling with so destructive an element as they are called to encounter would be greatly diminished, and the immunity from serious loss by fire now enjoyed by our citizens would be exchanged for the uncertainty and peril of former years.

Turning from these more general and public advantages secured by the public water supply, we call attention to those of a more private character. Of the dwellings in the city, including boarding-houses and hotels. 4,000 receive their daily supply of water from the public works. These dwellings shelter 6,000 families, whose numbers may be safely estimated at not less than three-fourths of the city's entire population. Water is also supplied to more than 700 business places; to 218 private stables; and most of the churches and public halls in the city are connected with the works. For watering the streets, and for keeping in good condition private grass plats and lawns, 1,047 hand-hose connections have been made. Without stating too much in detail, and referring to the statement of the Registrar for full information in regard to the use of water, we may be allowed to say that the public supply has reached all the departments of business, has found its way to a large majority of the homes of the people, and that its value and importance to the welfare of the city has come, year by year, to be more generally acknowledged.

It would seem that results so satisfactory, financially and otherwise, would have secured to the management of this department the approbation of the public. We are not without the belief that this is quite generally accorded. Yet we cannot but be aware that the "acts and doings" of the Board have been made the subject of unfriendly criticism. No large public work is ever prosecuted without encountering, to some extent, the prejudices and interests of a portion of the people. Differences of opinion will exist, and may be honestly entertained. But decisions must be reached, and work be begun; and whoever expects in the discharge of duties pertaining to such work to escape criticism — kindly of friends, harsh and unreasonable of enemies — is doomed to disappointment. The work incident to the construction and management of the water works of this city has received a full share of public attention. Early in the history of the works many were made to believe that so considerable an outlay as would be required to construct them, would entail upon the city large annual payments for interest, and consequently a much higher rate of taxation would become necessary. Interested parties persistently asked the public to believe that the direction taken for the sources of supply was wrongly chosen; and that those entrusted with the care and management of the works were at fault in their methods, purposes and plans. But the fears of the over-prudent have not been realized, the public have not yet come to believe that some other direction for our water sources should have been followed, or that the management of the department has not been considerate and just, and with reference to assuring the best possible attainable results. In closing this brief review of the past, this Board, practically one in its composition from the time of its organization, suggests no change of policy, abandons none of its plans for increasing the water supply of the city, and is as confident as ever that no required outlay in the future for the extension and enlargement of the works will bring a farthing of expense to the treasury of the city.

## COST OF THE WORKS.

In our report of a year ago we gave the gross cost of the works as $1,058,217.44, which amount as intended to correctly include the total amount of deficiencies in income to meet interest payments and cost of maintenance from the beginning. By an inadvertence the figures given in that statement as the cost of construction for the year 1879 were those representing the maintenance account of that year. As the maintenance account for the year was larger than the construction account by $1,379.97, the statement of the total gross cost of the works, January 1, 1880, should be reduced by that amount.

| | | |
|---|---|---|
| Total gross cost of the works, Jan. 1, 1880, as appears by last Annual Report | | $1,058,217 44 |
| Less error as above explained | | 1,379 97 |
| Total gross cost, as corrected, Jan. 1, 1880 | | $1,056,837 47 |
| Add Construction account for 1880 | | 27,397 38 |
| Total gross cost of works. Jan. 1, 1881 | | $1,084,234 85 |
| Less receipts from water takers for extra pipe laid, labor, etc | $35,954 45 | |
| Less premium on bonds sold | 9,750 00 | |
| Less income in excess of interest, payments, and cost of maintenance, 1879, 1880 | 30,140 08 | |
| | | $75,844 53 |
| Total cost of works to Jan. 1, 1881 | | $1,008,390 32 |

## WATER CONSUMPTION.

The quantity of water supplied to the city the past year was 452,000,000 gallons; a daily average of 1,238,290 gallons. These figures show a reduction in the quantity used the past year, as compared with the previous year, of about nine million gallons, notwithstanding the number of water-takers was considerably increased. This reduction was doubtless due in good part to a greater care in the use of water, induced by the circular issued by the Board, in June, stating the condition of the supply, and requesting water-takers to practice the strictest economy. In each of the following months, August excepted, the consumption was reduced below that of the same months in the previous year, the total reduction during the last half of the year amounting to 24,000,000 gallons.

That the consumption of water is not larger in our city than in other cities of the State having a like population, may be seen by the following comparison. The consumption given is that for 1879:

| City. | Miles of Pipe. | Daily Average. |
|---|---|---|
| Salem | 43 | 1,940,000 |
| Lawrence | 40 | 1,456,000 |
| Lowell | 57 | 1,890,000 |
| New Bedford | 40 | 2,056,000 |
| Fall River | 52 | 1,264,000 |
| Cambridge | 79 | 2,432,000 |
| Worcester | 77 1-2 | 2,500,000 |
| Lynn | 53 | 1,268,000 |

The report of the Superintendent furnishes an account of the sinking, at different points in the westerly section of the city, of what are popularly known as tubular wells. These wells were sunk in pursuance of instructions contained in an order passed by the City Council in May last. If we except from the statement the wells sunk in a small parcel of land owned by the city, on Boston street, near Cottage street, the results of the several attempts to find a supply of water that would warrant the setting up of pumping machinery were all unsatisfactory. It was well known that at this point a considerable flow of water found its way to the brook, which runs near by, coming to the surface through breaks in the clay stratum, and from wells bored through the clay to the gravel bed below. The quantity of water flowing was undetermined, although known to be continuous throughout the year.

Precisely where these wells were sunk was the somewhat noted spring known as the "Burchstead Spring." The water flowing from it has always been regarded as excellent; but of late it has been little used, and the spring and its surroundings have been sadly neglected.

At this point were sunk twenty-eight iron tubes of one and one-half inches diameter. Their reach into the ground varies from thirty-one to sixty-nine feet, according to the depth of clay pierced to reach the water-bearing gravel stratum beneath.

The situation of these wells is immediately upon the margin of Strawberry Brook, at the point where the flow of the brook meets tide water. This brook is the outflow of Flax Pond, and its course drains more than half a square mile of the settled territory of the city. A tide mill is situated farther down the stream, and its reservoir of water reaches to the point where the wells are sunk. Extreme high tides flood the well area. In all other directions the land rises.

If anywhere within the limits of the city there were indications that an underground supply of water could be found — suitable in quality and abundant enough in quantity to warrant the experiment now being tried — they existed at the locality selected. As we have said, the water flowing from the springs and wells in the neighborhood was excellent. A competent chemist had so declared it. The quantity, too, seemed large, and to one unaccustomed to measuring the flow of small streams appeared enough for half our city's supply. The twenty-eight wells sunk all proved to be flowing wells. It only remained to connect them with one large pipe, and that to the steam pump which had been provided, and a test of the capacity of this supply, and of the quantity of water it would continuously afford, could be made. To the consideration of the value of this supply to the city the remainder of this paper will be given.

## *CAPACITY OF SUPPLY.*

Except one day in October, the wells have been drawn upon, both night and day, since the 8th of September. The first few hours' work lowered the water rapidly; and it was soon found that the flow to the wells was not sufficient to feed the pump when working at its full capacity. The speed of the pump was gradually reduced, and accomodated to the quantity of water coming forward to the wells. The yield of the wells has been as stated on the following page.

| | | Gallons. |
|---|---|---|
| September, | 24½ days | 13,034,355 |
| October, | 30 " | 12,822,104 |
| November, | 30 " | 11,828,051 |
| December, | 31 " | 12,385,428 |
| January, | 31 " | 11,924,538 |
| February, | 28 " | 10,898,168 |
| Total quantity pumped | | 72,892,644 |

The above statement shows the result of the pumping of the wells for a period of six months. The average monthly yield has been 12,148,774 gallons; and the average daily yield has been 416,530 gallons. This quantity is nearly equal to one-third of the city's consumption for the same period, and as an expedient for meeting the exigency which existed, — caused by a short supply of water in our reservoirs, and the failure of the City Council to otherwise provide for such a contingency — was successful.

Whether the wells will yield as bountifully in the future as they have for the past six months remains to be seen. That the area drawn upon is large can be quite clearly shown, as the boundaries of the territory affected by the pumping can be approximately given. The westerly boundary seems to be indicated by the rise of land known as Tower Hill, which commences at Echo Grove, runs across the Poor Farm, intersects Myrtle Street, and thence on to the dam at Breed's Pond. This line is fixed upon as the probable limit in that direction because the springs and wells lying west of it do not appear to have been much, if any, affected. The northerly boundary is, without doubt, at the range of hills which form the background of the settled portion of the city. The easterly and southerly limits cannot be so definitely stated. It is known that the yield of the wells affects the artesian well of Judge T. B. Newhall on South Common Street, that of Edwin H. Johnson on North Common Street, and that of Henry Haddock on Mall Street. Wells on North Franklin Street, and on streets running from Boston Street to the hills, have been dry for many weeks. Within the area named all the natural springs, and all the wells bored through the clay, have either been completely dried or the water has fallen in them from eight to fourteen feet. None of the surface wells — wells above the clay stratum — seem to have been affected.

As there appears to be no obstruction to a flow of water to these wells from the east and south, except as the deep channels in our harbor may intercept it, it is possible that the entire gravel stratum which underlies the clay in the westerly half of the city, contributes to the supply. It is known that wells situated four thousand feet easterly have been lowered, and we cannot say how much farther in the same direction. If the wells be regarded as occupying the centre of a contributing area having a diameter of 8,000 feet, the draught upon them influences a territory of nearly two square miles. But this is not probable, and can hardly be regarded as possible. The probable contributing area is within the lines indicated, and comprises a territory not far from a square mile in extent.

The clay bed, for the most part, is impervious to water, although not without faults, as occasional spring-holes show. Its extent is known to be almost as broad as the area described. It reaches nearly to the hills on the north, is found at the harbor flats on the south, and is reached when digging wells of considerable depth in the territory that lies between. Below the clay lies the water-bearing stratum of gravel that feeds the wells. Its depth and capacity of supply, therefore, cannot be definitely known, but the data gathered and facts observed during the time the wells have been in use, furnish some valuable information, and the available supply can now be determined with considerable accuracy.

The yield of the wells has averaged but a little more than 400,000 gallons a day. Can this quantity be increased, or even made permanently reliable? We do not hesitate to say it cannot. First, the quantity pumped has been gradually diminishing. Second, the water level of the gravel stratum has been constantly dropping, as shown by the drying of springs and wells within the area drawn upon. These two facts conclusively show that the maximum of supply has been already reached. Not only that, but that the supply held in store in the gravel basin has been largely drawn upon; as a pond is drawn down when its supply is not equal to the draught made upon it. That no other underground sources, situated at a higher level, feeds this to any extent is also proved, for the level of the water table would not fall until they were exhausted if this basin was so fed. If it be said that during the well test the rainfall has been small, we reply that, no matter how small or how large the rain fall may be, the surface area contributing to the well supply is too limited to furnish the quantity of water that is even now being delivered. A heavy rainfall may temporarily, not permanently, increase it.

It will be admitted that this stratum of water-bearing gravel can only be replenished by the rainfall. It is also known that an impermeable body of clay overlays the gravel stratum from which this supply of water comes. Through this the rainfall cannot pass; and in no other way can it reach the gravel beds than as it filters through the loose earth beyond the outer rim of the clay. This is an exceedingly narrow belt of land, and for the most part lies at—and near—the base of the hills that bound on two sides the area we are considering. There is, then, but the smallest opportunity for the rainfall to reach the underground basin from which the wells are fed. If the continuous pumping of the wells does not justify this conclusion, then it must be assumed that the rainfall finds its way to the gravel bed through a faulty clay stratum. But if this were true to any extent the water first drawn from the wells should have shown a larger amount of impurities, for in such case the principal gathering ground of the supply could only be a thickly settled portion of the city.

It is not probable that there are many faults in the clay bed. Those known are mainly springs, which ordinarily show the ground to be full of water at points where they appear and not in a condition to receive more. It is also to be observed that the few springs which make their appearance are in the immediate vicinity of the wells, and are, therefore, at too low a level to be feeders of the supply, except when the pump is working and the water in the wells is drawn down. Our conclusion, therefore, is, that the area actually contributing to this underground water source is quite limited, and cannot be regarded as conveying to it more than one-third of its present yield.

There is further evidence to support this view. When the wells were all sunk they were allowed to flow naturally for several days. At first the water would rise in the pipes two feet above the surface, but in a few days the head was diminished, and consequently the volume of the flow. Measurements of the flow over a wier showed the discharge of the wells to be less than 150,000 gallons in twenty-four hours. This at the beginning of the experiment, and before the accumulated store of water had been much drawn upon. A diminishing flow can only be regarded as an indication that the source of supply is not capable of sustaining the draught made upon it. So when the steam pump was first applied and the wells were drawn down, they would soon fill upon stopping the pump. But no later than a day in October the wells did not fill in twenty-four hours; and the accumulation of water during that time was all taken out in less than an hour's work of the pump.

Notwithstanding what we have already said, nearly 73,000,000 gallons have been pumped from the wells, and their yield is still some 400,000 gallons. If the area which can feed this underground supply is so limited, from whence does the water come? Our answer is, that the wells are delivering the water from beneath the clay bed which stretches across a considerable portion of the settled territory of the city, and that the water so delivered is the accumulation of years. The natural overflow, or outflow, of this basin is found in the vicinity of the wells. It is to be remembered that they are at tide-water, and much below the general level of the city. The natural waste of this basin does not exceed (it is probably something less,) 150,000 gallons a day, as we have shown. Yet the wells are delivering 400,000 gallons a day, and have delivered a much larger quantity.

But this draught upon them is constantly dropping the underground water-table. Practically a new point of overflow has been made. Before pumping began it was at the surface, it is now nineteen feet below the surface, for the pump, working at half speed, delivers all the water which comes forward to the wells at that depth. The pump exhausts the water held in the gravel basin as effectually as if the natural point of overflow was nineteen feet lower than it is known to be. The quantity of water pumped is therefore as large (it is really somewhat larger,) as would be delivered from an opening in the clay stratum nineteen feet below the surface, with an unobstructed water-way to the sea.

To illustrate: suppose Breed's Pond to be full of water to the point of overflow. If none was being drawn from it, and the brooks were feeding into it 100,000 gallons a day, that quantity would pass daily over the waste-way. This waste would be the measure of its capacity of supply without drawing upon its storage. But if a pumping engine should be set up at the dam, connected with twenty-eight one and one-half inch tubes reaching twenty feet deep into the pond, it could easily be made to deliver more water than was flowing into the pond; and although 400,000 gallons might be pumped for many months, the continuous capacity of supply would still be but 100,000 gallons. So with the tubular well supply. Its capacity of supply is to be measured by the natural overflow of the gravel basin, or stratum, whichever it is, when full of water; not at all by what may be pumped from it, when pumping rapidly lowers the water-table and reduces the quantity of water held in store.

We have thus far discussed the yield of the wells as if it was surely known that the water drawn from them is wholly derived from the gravel beds into which they are sunk. But this is not certain. On the contrary, it seems not only possible, but probable, that quite a percentage of the supply from the wells has been taken from the brook and mill-pond. A careful examination of the surroundings of the well area, and a study of the record kept and observations made during the time the wells have been in use, lead us to this conclusion. The ground into which the wells are driven is in close proximity to the brook, and almost at a level with it. The mill-pond just below rises and falls with the tide, and when full sets back quite to the wells. It is in this vicinity that the clay stratum is most broken. Here a number of perennial springs appeared before the wells were driven. The most important of them were within the area occupied by the wells, and the water flowing from them suggested the idea that here an underground supply of water could be obtained. It is known that several of the wells were sunk without passing through the clay bed. It is also known that several springs existed in the bed of the brook, and along its banks, before the pumping of the wells exhausted their supply. There are other indications that the clay bed in the immediate vicinity of the wells is considerably broken, at least that it is imperfect and permeable.

With such surroundings, and the pump constantly at work, is it not almost certain that the brook and pond are to some extent drawn upon for the well supply? It is to be remembered that when the pump is working the water in the wells is constantly drawn down, and most of the time stands nineteen feet below the surface. The falling of the water in the wells is the result of the lowering of the water level in the immediate neighborhood of the wells. The falling of the water-table stops the flow of the springs, and converts these clay openings from outlets to the ground water to inlets for water from the brook and pond. That the springs and wells are connected is shown by the equal fall of water in both; and since before pumping began the springs afforded water abundantly to the brook, why should they not now be the medium of conveying water from the brook to the wells?

The observations of the day engineer at the pumping station confirm the view we have presented. He states that there is always a perceptible increase of water at the wells at high tide, and that it is especially noticeable at the time of the spring tides. He also says that when he has occasion to stop the pump for a few minutes, for slight repairs, air escapes rapidly from the ground where the wells are situated; and for a considerable distance over the flats that lie between the wells and the bed of the brook, innumerable air bubbles break upon the surface as the ground fills with water. These facts have frequently been within our own observation. Before the wells were put in, the ground where they are situated was flowed at every high tide. To hide the filthy spot from view, and to protect the wells from the inflowing tide, it was covered with gravel. But this thin covering can only partially protect the wells from the flow of the brook when the tides are at their full, and does not hinder the drainage of the street and dooryards,—in times of rain carried to the well area,—from finding its way to the water gathered at the foot of the wells.

Confirmatory also of the opinion we have expressed are the analyses of the well water made by Professor Nichols. The first of these was made on the 30th of June, before pumping began and when the wells were flowing. The chlorine at that time was but 1.40, and the total solids but 12.90, in 100,000 parts; while on the 10th of February the water showed in 100,000 parts 4.50 of chlorine, and 20.70 of total solids. We are at a loss to account for this somewhat rapid deterioration of the quality of the water except upon the theory already suggested; namely, that to a greater or less extent the water of Strawberry Brook, and the millpond below, mingles with the ground water as it flows to the wells, increasing the quantity pumped and impairing its quality.

How capacious this subterranean reservoir may be, what its depth, and the quantity of water it is capable of yielding before being exhausted, are questions that do not admit of definite answers. It may be that the supply is inexhaustible. It may be that the sinking of more wells will make available a larger percentage of the water thus stored. A larger engine and greater pumping capacity, placed at a lower level, may aid in securing it. But to pursue the experiment further, means the expenditure of thousands of dollars when only a possible chance of success attends upon the outlay. It is to choose to deal with uncertain quantities and unknown conditions when certainty in regard to both can be easily secured. It is to refuse to accept a well-considered plan for increasing the water supply, one having the endorsement of some of the most eminent engineers of the country, and to adopt instead the vague notions of empirics and pretenders.

## QUALITY OF THE WELL WATER.

The doubtful character of any underground supply of water, especially when it is drawn from beneath a territory occupied by a densely settled community, makes frequent examination of its quality a duty not to be disregarded. Before making the well water a part of the city's consumption, the Board engaged the services of Professor Nichols, of the Institute of Technology, Boston, to examine it. Professor Nichols has given great attention, and devoted much time and thought, to the questions pertaining to drinking water and water supplies. He has been frequently employed by the State Board of Health, and by the city of Boston. His field of observation has been large, and his acquaintance with the subject has gained for him a reputation not excelled by that of any analyst. We introduce into this report a few paragraphs, applicable to the examination of water for domestic use, taken from a paper prepared by him for Buck's Hygiene, entitled "Drinking Water and Water Supplies."

*Organic matter.*—In the examination of water there are few *inorganic* substances to be determined as bearing on the sanitary quality of the water, except in so far as they indicate sewage contamination, and the total amount of inorganic matter may be quite large without rendering the water unwholesome; it is different, however, with the organic matter.

Since there is a disagreement among medical men as to the nature of the injurious substances in polluted water, and since even with regard to decomposing sewage no one knows for a certainty in what its power for harm resides, it is not expected that analysis can say with absoluteness of statement whether a given water is *dangerously* polluted or not. Indeed, we may say that chemistry does not give us the means of determining the amount of organic matter in water, or even of determining, in all cases, whether it is of animal or vegetable origin.

There are many persons who suppose that the way to consult a chemist in the matter of water-supply is to send a sample of water in a sealed vessel, with no hint as to its source; and they expect the results of the chemical examination of the water to be accompanied by a statement as to the wholesomeness of the water, or of the possibility of danger from its use. The chemical examination is of great service, and often indispensable; but, except in cases of gross pollution, it is *impossible* to pronounce definitely on the water without a knowledge of the locality from which it is taken.

Now, although the term "organic matter" sounds as if it meant some definite thing, this is not the case. For instance, a pound of sugar, a pound of albumen, and a pound of excrement, are very different things. Some organic matter contains a large and some a small percentage of carbon; the same is true with reference to nitrogen, to hydrogen, and to oxygen, which make up the bulk of all organic matters. Even if the chemist could say with all assurance that a certain water contained exactly one or two or five parts of organic matter in 100,000, we should be very far from having the data necessary for forming an opinion of the water. But the chemist cannot make any such statement.

We come now to the interpretation of the results of the analytical examination. Some general principles may be laid down for the interpretation, although, in the majority of cases, chemical examination alone cannot be relied upon as giving conclusive evidence as to the suitability of a water for drinking. Of course, if a water is hard, the chemist can say, without hesitation, that the water is unsuited for supply on account of its probable effect on steam-boilers, and because it will be uneconomical for use in washing. If the water contains arsenic or lead, or other poisonous metal, the chemist can discover it. If the water is grossly polluted, or is of exceptional purity, chemical examination can determine these facts; but, in a vast majority of cases, while chemistry may teach something and aid in the decision, it cannot teach everything, and it cannot *decide*. Now, it would be very convenient, if it were possible, to take each item which is made the object of analytical determination, and say that a good water may contain so much, and if a water contains more, it is not good. This is impossible; a certain amount of the same substance might in one case be a sign of fearfull contamination, while in another it might indicate only a normal constituent of the water.

In view of the impossibility of saying exactly what is and what is not harmful, any considerable departure from the normal character of the water in a given locality should be regarded with suspicion. It is true that various students of the matter of water-supply have formulated "standards" which a water may not overpass. They are, however, only of relative value. Moreover, different kinds of water cannot be judged by the same standard, a fact that is often lost sight of.

## EXAMINATION OF GROUND-WATER.

[illegible] expressed in Parts in 100,000.]

| [illegible] | Ammonia. | Albuminoid Ammonia. | RESIDUE. Inorganic. | Organic and Volatile. | Total at 212° F. | Chlorine. | Nitrates. | Remarks. |
|---|---|---|---|---|---|---|---|---|
| [illegible] | | | | | | | | |
| [illegible] | [illegible] | [illegible] | 4.84 | 1.80 | 6.64 | 0.24 | | |
| [illegible] | [illegible] | [illegible] | 5.20 | 1.20 | 6.40 | [illegible] | | |
| [illegible] | [illegible] | [illegible] | 5.20 | 1.20 | 6.40 | 0.44 | | |
| [illegible] | [illegible] | [illegible] | 5.60 | 0.92 | 6.52 | 0.38 | | |
| [illegible] | | | | | | | | |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 11.6 | Large am't. | Bad. |
| [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | [illegible] | Trace. | Suspicious. |
| [illegible] | [illegible] | [illegible] | | [illegible] | 50.52 | 11.72 | Small am't. | Suspicious. |
| [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | [illegible] | Large am't. | Very Bad. |
| [illegible] | [illegible] | [illegible] | | [illegible] | 31.12 | 3.20 | Trace. | Suspicious. |
| [illegible] | [illegible] | [illegible] | | [illegible] | 44.92 | 10.20 | Trace. | Bad. |
| [illegible] | [illegible] | [illegible] | | [illegible] | [illegible] | [illegible] | Trace. | Suspicious. |

[illegible] must regard with suspicion a water [illegible] parts of ammonia, from 0.006 [illegible] ammonia," and say 1.0 part of [illegible] any appreciable amount of [illegible] presence in the uncon- [illegible] ferrous sulphate) test. [illegible] condemnation of the [illegible] in one particular only; [illegible] location of the well, and [illegible] abnormal quantity [illegible] suspicions thrown upon [illegible] chemical examina- [illegible] sample of water hardly [illegible] the well. It often [illegible] — that is, at cer- [illegible] at others. Where [illegible] is a quite satis- [illegible] time to time the [illegible] Take, for instance, [illegible] well-water are abnor- [illegible] the pump or has been scattered about the well to kill weeds; in such cases, any suspicion excited by the presence of chlorine is allayed when the circumstances are known. As a rule, however, the chlorides come from cess-pools or vaults; and as chlorine is easily determined, it may be selected as the object of a number of consecutive examinations. In this way it is possible to ascertain whether the water is subject to much variation, and a more particular examination can be made at times when the chlorine proves to be present in larger proportion than usual. If a particular vault or cess-pool is suspected, it is advisable to throw a quantity of strong brine (*i. e.*, a solution of chloride of sodium) into the suspected source of contamination, and observe whether, and after how long an interval, the proportion of chlorine in the well shows an increase. Salts of lithium are also used for the same purpose, as a very minute amount of lithium can be detected by the spectroscope.

With regard to the determinations other than those mentioned above, it may be said, that in order to make the determination of the "total solid residue" of any value, something must be known of the geological character of the region or of the water of wells known to be unpolluted. As much as forty or fifty parts of total solids in 100,000 parts of the water may often be allowed in drinking-water, provided they are of such a character as to be harmless; but, in the case of shallow wells supplied from the ground-water, such an amount could be considered admissibly only under very peculiar circumstances; it might, perhaps, be allowed in wells near the sea.

## SANITARY EXAMINATION OF DEEP WELLS.

In the case of deep wells and springs there is less likelihood of contamination than in the case of shallow wells, as has already been seen. The chief danger arises from surface drainage, the likelihood of which can generally be estimated from an inspection of the surroundings, and from which the wells can generally be protected.

In regard to the "albuminoid ammonia" and to the organic carbon and organic nitrogen, the same rules will apply as in the case of shallow wells; but in the case of deep wells the total solid residue, the chlorine, the ammonia, and the nitrogen as nitrites and nitrates are of no value as tests of impurity, since unpolluted deep water often contains considerable quantities of one or more of these substances.

In the case of deep wells, however, more importance attaches to the particular analysis of the dissolved solids than in the case of any other class of water. It is almost always true that the water contains a comparatively large amount of saline matter, and it is important to ascertain the proportion of the various salts which make it up. Especially to be avoided are sulphate of lime and the sulphate and other salts of magnesia. Of course this has reference to the continued use of the water. Some waters containing a quantity of purgative salts may be valuable as medical agents, but are unsuited for daily use. It is important also to know the hardness of deep-well waters if the water is intended for a general supply and not simply for drinking.

## SANITARY EXAMINATION OF SURFACE WATERS.

With the views which are at present held with reference to the danger from the pollution of lakes and streams by sewage and other refuse substances, the most important part of the sanitary examination of such sources of supply is the inspection of the locality from which the water is to be taken and of the surroundings. If the stream or lake receives, in proportion to its size, any considerable amount of sewage or of manufacturing refuse, it should be rejected as a source of supply independent of any chemical examination. The principal difficulties in the way of the satisfactory chemical examination of surface-waters are three in number: In the first place, the volume of water is generally so large that, even when polluting matter is known to be present, the dilution is so great as to prevent the detection of unmistakable evidence of contamination. In the second place, all surface-waters contain more or less of organic substances — substances containing carbon and nitrogen — which it is impossible to refer definitely to animal or vegetable sources, or otherwise to distinguish as harmless and harmful. In the third place, the water of such streams and ponds is subject to very considerable variation, so that the examination of a single sample is of comparatively little value. It may be possible, it is true, to state from the chemical examination of a single sample that no considerable or no appreciable contamination exists; it is impossible to recommend a water for drinking without knowing something of the situation and surroundings of the source from which it is taken.

The following statements will serve to illustrate the variations to which river and pond waters are subject. Weekly examinations of the water supplied to the city of Boston were made from July, 1876, to June, 1877, inclusive. The ammonia varied from 0.0005 to 0.0056, the "albuminoid ammonia" from 0.0099 to 0.0176, the total solids from 3.72 to 5.58, all these results being expressed in so many parts in 100,000. In like manner, examinations were made nearly every week during the year 1877 of the water of Ludlow reservoir, a recently flowed artificial pond, which forms the larger portion of the supply of Springfield, Mass., and which has every summer a copious growth of microscopic algæ. The ammonia varied from 0.0024 to 0.0403; the "albuminoid ammonia" in the unfiltered water, from 0.0173 to 0.0899; in the water after filtration through paper, from 0.0160 to 0.0432; and the total solids, from 3.36 to 6.72. A similar variation is shown in the monthly examinations which are made of the Thames water, in London.

We have quoted more largely from the paper referred to than we at first intended. But as the analyses of the well water made by Professor Nichols are to follow, his opinion of the worth of them, and, indeed, of the analysis of any water, independent of all knowledge of the surroundings and conditions that may affect it, becomes interesting and important.

It will be seen by the table below that eleven analyses of the well water have been made, and that they have been made with reference to determining the amount of chlorine, and total solids, the water contained. We incorporate them into this report without comment or inferences of our own. We invite attention, however, to the fact that the chemical examination of the well water has shown an increasing quantity of foreign matter mingling with it as pumping proceeded, and that this increase suggests an inflow of water to the wells from some other source than that from which it was at first drawn.

The hardness of the water since the well water has made a part of the general supply, has given cause of complaint to consumers in all parts of the city. This is a matter of much more importance than many have supposed. From careful experiments made by the River's Pollution Commission, of England, it was determined that one degree of hardness in water required a pound of best hard soap to soften a thousand U. S. gallons. Assuming that twenty-five per cent. of the well water is used for washing purposes, seven hundred pounds of good soap would be required per day to neutralize its hardness and bring it to the softness of the pond water. This would represent a loss to the water-takers of the city of $17,885.00 a year; or an average loss to each family taking the water of more than three dollars annually. If this sum was capitalized at four per cent. per annum, it would represent nearly $450,000. In other words the water-takers are losing, by using the tubular well water, as much money as if they were called upon to bring soft water to the city at a cost of $450,000 and pay four per cent. interest on the same.

ANALYSES OF WATER FROM THE TUBULAR WELLS, MADE BY PROF. WM. RIPLEY NICHOLS, OF THE MASS. INST. OF TECHNOLOGY, BOSTON.

| Number. | Date. | Parts per 100,000. | | Grains per Gal. | | Hardness. |
|---|---|---|---|---|---|---|
| | | Chlorine. | Total Solids. | Chlorine. | Total Solids. | |
| | 1880. | | | | | |
| *1 | June 30 . . | 1.40 | 12.90 | 0.80 | 7.50 | not taken. |
| †2 | July 24 . . | 5.20 | 24.00 | 3.00 | 14.00 | not taken. |
| 3 | Sept. 13 . . | 1.50 | 13.20 | 0.90 | 7.70 | 5.00 |
| 4 | Sept. 21 . . | 1.60 | 15.40 | 0.90 | 9.00 | 5.30 |
| 5 | October 7 . | 1.60 | 12.80 | 0.90 | 7.40 | not taken. |
| 6 | October 29 . | 2.20 | 13.20 | 1.28 | 7.71 | 6.00 |
| 7 | December 9 | 3.15 | 17.20 | 1.84 | 10.00 | 7.70 |
| 8 | Decemb'r 30 | 3.50 | 17.80 | 2.04 | 10.39 | 8.00 |
| | 1881. | | | | | |
| 9 | January 21 | 3.95 | 19.80 | 2.31 | 11.56 | 8.70 |
| 10 | February 10 | 4.50 | 20.70 | 2.63 | 12.09 | 8.70 |
| 11 | February 26 | 4.35 | 21.70 | 2.54 | 13.67 | not taken. |
| Breed's Pond | July 30, 1880 | 0.49 | 3.68 | 0.29 | 2.15 | |
| ‡ Birch Pond | July 30, 1880 | 0.75 | 10.32 | 0.44 | 6.03 | |

* Water taken from the wells when flowing, and before pumping began.

† Water taken from the wells while temporarily pumping, and before the well area was covered with gravel.

‡ Water taken from the pond when at a low stage, and at its worst, when affected by a microscopic vegetable growth.

## COST OF THE WELL WATER.

It will be proper in this connection to state the cost per million gallons of the well water, and pond water, delivered to the well chamber at the engine-house. The total cost of Breed's and Birch Ponds, including the pipe conduits, which connect them with the engine-house, is $134,885.72. The annual interest on this sum, at 6 per cent., is $8,093.14. As the burden of a debt to a community is the interest which must be paid, the annual interest on the cost of these ponds and their connections is, substantially, the cost of the water they afford.

The quantity of water drawn from the ponds for use during the last seven years, from 1874 to 1880, both inclusive, has averaged 432,818,038 gallons. Cost per million gallons, $18.70. The cost of the well water, per million gallons, including interest on the outlay, has been $28.42. We leave, without comment, this statement of comparative costs to the consideration of the City Council.

## WATER SUPPLY.

In the annual reports of the Board especial pains have been taken to seasonably inform the City Council of the necessity that exists for increasing the water supply of the city. To relieve this Board from all responsibility for a failure in the supply, whether arising from a rapidly increased consumption or from a period of unusually low rainfall, two special Memorials upon the subject have been sent to the City Council. The committees to whom they were referred reported favorably upon them, and the two branches of the City Council concurred in the passage of the proper orders requesting the Mayor to petition the Legislature for authority to take additional water sources. In each instance, we regret to say, there was a failure on the part of the Mayor to comply with the request.

This action leaves to this Board no alternative but to again bring the matter to the attention of the City Council, and the public, through the medium of their annual report. We do not, however, propose to discuss the question, or present anew the reasons for an increase of the supply, already so fully set forth in our reports. It would seem that a Board composed of ordinarily intelligent citizens, to whom has been committed for almost a decade of years the care and management of the water works of the city, should have acquired such accurate knowledge of the wants of the department as would ensure attention to any suggestion it might make, and gain for its recommendations respectful consideration. Nor does it seem too much to say that any citizen — even a public official—whose attention is only casually drawn to the consideration of so important a subject as a city's water supply, will more surely find himself in the right if he accepts the judgment of those who have studied the matter, who have consulted those competent to impart knowledge, and whose opportunities for a full understanding of all the facts bearing upon the subject have been ample, than if he rely upon his own hastily-drawn conclusions and immature knowledge to determine his course and justify his action. We renew our recommendation that Hawkes and Penny Brooks be obtained and made a part of the water supply of the city.

*For the Public Water Board,*

EDWIN WALDEN,
JAMES PURINTON,
DAVID H. SWEETSER,
THOMAS B. NEWHALL.

# REPORT OF THE WATER REGISTRAR.

*Hon. Edwin Walden, President of the Public Water Board:*

DEAR SIR: — I herewith respectfully present the Report of the Water Registrar, for the year ending Dec. 31, 1880.

## SERVICES.

The whole number of services Jan. 1, 1880, was 4127; number of new services put in during the year, 363; discontinued — buildings moved — 2; total number services Jan. 1, 1881, 4488.

There was shut off during the year, for non-payment of water rates, 23; for violation of the rules, 2; let on again by payment of rates and fines, 16; 1 was let on for other parties in the same building, — the fixtures having been removed from the room of the party that did not pay; still remaining off, 8; number let on that was shut off for non-payment previous to 1880, 5.

Jan. 1, 1880, there were 41 services remaining off, — premises vacant; there has been shut off during the year, for the same cause, and by request, 88; let on again — premises reoccupied — 94; still remaining off, 35.

There has been 8 services put in at East Saugus during the year, making 50 in all, to Jan. 1, 1881.

The premises supplied with city water have been examined by the Inspector, and all places and fixtures not found in good condition the parties were immediately notified to put them in good order or the water would be shut off, and the usual fine demanded before the water would be let on again.

The ratio of increase in the number of services for the last six years has been as follows:

| | | | |
|---|---|---|---|
| In 1875 . . . . | 5.25 per cent. | In 1878 . . . . | 6.14 per cent. |
| 1876 . . . . | 6.54 " | 1879 . . . . | 6.04 " |
| 1877 . . . . | 7.60 " | 1880 . . . . | 8.75 " |

## RECEIPTS FOR THE YEAR 1880.

| | | |
|---|---|---|
| r the use of water for all purposes . . . | $79,690 14 | |
| For fines — water shut off and let on again . | 46 00 | |
| For rent . . . . . . . . . . . . . . . . | 41 38 | |
| For summons . . . . . . . . . . . . . . | 121 40 | |
| | | $79,898 92 |
| For extra pipe, labor, etc . . . . . . . . | | 2,056 39 |
| Total receipts . . . . . . . . . . . . . | | $81,955 31 |

All of which has been paid into the City Treasury.

There is due on water ; on meter rates, $2,556.50; on account of extra pipe, $24

## COMPARATIVE STATEMENT )F REVENUE FOR 1880.

| | | |
|---|---|---|
| Amount collected in 1880, . . . . . . . . . | $79,898 92 | |
| Due and uncollected . . . . . . . . . . . | 2,633 75 | |
| | | $82,532 67 |
| Deduct amount due at beginning of year . | | 2,897 55 |
| Revenue for 1880 . . . . . . . . . . . . | | $79,635 12 |
| Revenue for 1879 . . . . . . . . . . . . | | 73,949 80 |
| Increase of revenue for 1880 . . . . . . . | | $5,685 32 |

## STATEMENT OF INTEREST, MAINTENANCE AND REVENUE FOR THE YEAR 1880.

| | | |
|---|---|---|
| Revenue for 1880 . . . . . . . . . . . . | | $79,635 12 |
| Interest for 1880 . . . . . . . . . . . . . | $52,230 00 | |
| Maintenance for 1880 . . . . . . . . . . | 10,277 93 | |
| | | $62,507 93 |
| **Excess of revenue over interest and maintenance . . . . . . . . . . . . . . . .** | | **$17,127 19** |

## EXPENDITURES FOR 1880.

### MAINTENANCE.

| | | |
|---|---|---|
| Salaries and office expenses | $3,399 80 | |
| Repairs on services | 715 58 | |
| Repairs on mains, hydrants and gates | 867 25 | |
| Pumping, wages, coal, oil, etc | 4,319 71 | |
| Repairs on boilers | 60 10 | |
| Stable and workshop | 834 97 | |
| Labor at Breed's pond | 53 87 | |
| Labor at reservoir | 26 65 | |
| Total maintenance | | $10,277 93 |

### CONSTRUCTION.

| | | |
|---|---|---|
| Services and court mains | $7,389 58 | |
| Mains, hydrants and gates | 13,455 92 | |
| Meters | 309 06 | |
| Shop and stable | 53 00 | |
| Tubular wells | 6,189 82 | |
| Total construction | | $27,397 38 |

Following are tables showing the number of families, dwellings, stores, factories, hotels, etc., etc.; the yearly revenue of the department; the number and kind of fixtures; the class of premises to which metres are attached, etc., etc.; all of which is respectfully submitted.

SIMON J. RONEY,
*Water Registrar.*

# STATEMENT

SHOWING THE NUMBER OF FAMILIES, DWELLINGS, STORES, FACTORIES, ETC., SUPPLIED WITH CITY WATER FOR THE YEAR 1880.

| | |
|---|---|
| Dwellings | 3323 |
| Families | 5732 |
| Boarding-houses | 70 |
| Hotels | 7 |
| Stores | 308 |
| Offices | 120 |
| Restaurants and saloons | 48 |
| Stables | 218 |
| Stationery steam-engines and boilers | 78 |
| Factories | 147 |
| Railroads | 3 |
| Steam fire-engine houses | 4 |
| School-houses | 27 |
| Churches | 14 |
| Public halls | 15 |
| Printing offices | 9 |
| Green-houses | 13 |
| Bakeries | 8 |
| Barber shops | 13 |
| Planing mills | 4 |
| Machine and blacksmith shops | 12 |
| Markets | 7 |
| Banks | 5 |
| Photographers | 6 |
| Public and drinking fountains | 8 |
| Motors | 7 |
| Laundries | 3 |
| Reservoirs | 4 |
| Foundry | 1 |
| Private fountains | 13 |
| Gas works | 1 |
| Hand hose | 1047 |
| City Hall | 1 |
| Almshouse | 1 |
| Post office | 1 |
| Fire hydrants | 411 |

## STATEMENT

### SHOWING THE YEARLY REVENUE OF THE WATER DEPARTMENT SINCE THE FIRST INTRODUCTION OF WATER INTO THE CITY IN 1871.

| | | |
|---|---|---|
| From October 1, 1871, to January 1, 1872 | $ 8,989 | 00 |
| From January 1, 1872, to January 1, 1873 | 27,568 | 16 |
| From January 1, 1873, to January 1, 1874 | 47,992 | 61 |
| From January 1, 1874, to January 1, 1875 | 53,545 | 61 |
| From January 1, 1875, to January 1, 1876 | 52,553 | 26 |
| From January 1, 1876, to January 1, 1877 | 60,867 | 12 |
| From January 1, 1877, to January 1, 1878 | 64,002 | 50 |
| From January 1, 1878, to January 1, 1879 | 67,570 | 14 |
| From January 1, 1879, to January 1, 1880 | 73,949 | 80 |
| From January 1, 1880, to January 1, 1881 | 79,635 | 12 |
| Total | $536,673 | 32 |

# STATEMENT

SHOWING THE NUMBER AND KIND OF FIXTURES CONTAINED WITHIN THE PREMISES OF WATER-TAKERS, TO DECEMBER 31, 1881, AS COMPARED WITH THE PREVIOUS YEAR.

| Kind of Fixtures. | 1879. | 1880. | Increase. | Decrease. |
|---|---|---|---|---|
| Faucets | [illegible],897 | 8,879 | 982 | |
| Bath tubs | 423 | 481 | 58 | |
| Water closets | 1,321 | 1,483 | 162 | |
| Urinals | 41 | 38 | | 3 |
| Hand hose | 1,024 | 1,047 | 23 | |

# STATEMENT

## EXHIBITING THE CLASS OF PREMISES TO WHICH METERS ARE ATTACHED.

| Class. | Size. | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | 1-2 | 5-8 | 3-4 | 1 | 1 1-2 | 2 | |
| Railroads | | | 1 | 3 | | 2 | 6 |
| Engines | | 4 | 10 | 21 | 2 | | 37 |
| Factories | 2 | 27 | 15 | 19 | | | 63 |
| Halls and buildings | | | 2 | 2 | | | 4 |
| Hotel | | 1 | | | | | 1 |
| Livery stables | | 5 | | | | | 5 |
| Saloon | | | 1 | | | | 1 |
| Laundry | | 1 | | | | | 1 |
| Gas works | | | | | 1 | | 1 |
| Steam engine house | | | | 1 | | | 1 |
| Dwelling | | 1 | | | | | 1 |
| Totals | 2 | 39 | 29 | 56 | 3 | 2 | 121 |

# REPORT OF THE SUPERINTENDENT.

*Hon. Edwin Walden, President of Public Water Board:*

SIR — In compliance with the City Ordinance, I respectfully submit, herewith, the Annual Report of the Superintendent.

## PONDS.

At Breed's Pond a small outlay was made in the Spring to repair the damage to the outside slope of the dam, caused by the winter rains. As soon as the grass began to start, the grounds being destitute of fences, were trodden up by the cattle, which run at large in that vicinity, and spoiled. It is useless to attempt to improve the banks until the grounds are fenced, and it is hoped that next season we may see this much needed improvement accomplished.

No expense has been incurred at Birch Pond during the year. The fences along the line of Walnut Street, nearly the entire length of the pond, are in a very dilapidated condition, and require to be renewed in the near future. The water in this pond was drawn quite low early in the season, and during the hot weather it became affected with a vegetable growth, so that no water was used from the pond during that time. Upon the advent of cool weather in the Fall, the vegetable growth disappeared, and the water became clear and free from taste or odor, and has been in constant use since early in November.

Owing to the low rainfall of the Winter and Spring, and the low stage of the water in the ponds at the beginning of the year, neither pond has been full and no water has run to waste this year. On the first of January, 1880, the depth in Breed's Pond was eight feet; the depth in Birch Pond was ten feet four inches. On January 1, 1881, the depth in Breed's Pond was eight feet five and one-half inches; the depth in Birch Pond was seven feet seven and one-half inches; showing a loss in both ponds, for the year, of about fifty millions of gallons.

The rainfall for the year has been 37.28 inches. The yield of the water-shed, available for consumption, has been 39.38 per cent. of the rainfall, equal to 14.68 inches over the drainage area, exclusive of water surfaces. The total consumption for the year has been 100,000,000 gallons more than the amount received into the ponds from the rainfall. On the twenty-third of June the Board issued a circular stating the condition of the water supply, and requesting that the utmost economy should be practiced in the use of water. So well was this request complied with by the water takers that the consumption was reduced in the succeeding months more than twenty-four millions of gallons below the consumption of the same months in the previous year, notwithstanding an increase of over six hundred families in the number of consumers.

## TUBULAR WELLS.

It became evident early in the year that we were in great danger of coming short of water before the close of the year, unless some means were adopted to increase the supply. On the twenty-fifth of May the City Council passed an Order, instructing the Water Board to put in a sufficient number of tubular wells to thoroughly test the capacity of an underground water supply. In accordance with these instructions, an arrangement was made with J. E. Robinson, a contractor in the business, to sink the necessary wells. Several wells were sunk near the pumping-station, also at the Poor Farm, and just below the dam at Breed's Pond, without much success. A number were sunk near the old Burchstead spring, on Boston Street, with better success, which, after a few days temporary pumping, showed that considerable water might be obtained from that locality. Preparations were therefore made for a thorough test. The place was covered with clean gravel to keep back the water from the brook. The number of wells was increased to twenty-eight, and connected with a Knowles Pump of 18 inches steam cylinder, 12 inches water cylinder, and 24 inches stroke. A tubular boiler, 4 feet in diameter and 16 feet long was set up to furnish steam, and a small building erected for an engine and boiler house. The pump was provided with an automatic counter to register revolutions, a pressure gauge, vacuum gauge, and index for obtaining the length of stroke, and every care was taken to obtain a correct record of the experiment. A pipe was laid across Boston Street, with a check-valve and gate included, to connect the pump with the distributing main, and a gate placed in the Boston Street pipe, by which we were enabled to separate a portion of Boston Street, and Kirtland and Walnut Streets, from the general distribution of the city, and use that pipe for pumping from the wells direct into Breed's Pond, without the expense and delay of laying an independent pipe for that purpose.

The wells are twenty-eight in number, of one and one-half inch pipe, and were all flowing. The depth to which they are driven varies from thirty-one to sixty-nine feet. The clay is very irregular in thickness, and much broken up. At three of the wells no clay was found; at the others it varied in thickness from one foot to thirty-four feet, and the distance from the surface at which the top of the clay was found varied from two to twenty feet. An extra well was sunk near the center of the group as a test well for measuring the fall of the water.

Pumping was commenced on the fourth of September; on the sixth of September the pump was stopped to alter the steam valve, and started again on the eighth, since which time it has worked constantly, both day and night, up to the present time, with the exception of the twenty-fifth of October, when it was stopped for twenty-four hours, and the necessary stoppages of a few minutes every two or three days to examine the pump valve and packing.

The first few hours' pumping lowered the water in the wells very rapidly, and showed that the water would not flow to the wells fast enough to allow the pump to be run at its full capacity; consequently the speed of the pump had to be regulated so as to pump all the water that could be obtained from the wells. As the water-table was gradually lowered the quantity the wells could furnish was diminished, and the number of strokes of the pump was decreased. The latter part of November a leaky well was replaced by a new one, which enabled us to draw the wells two feet lower than before, and increased the quantity pumped in December.

Before pumping was commenced the wells in the vicinity were measured by the City Engineer, and have been measured at intervals since. The wells above the clay, in the immediate vicinity of the pump, have not been affected by the pumping, while all the natural springs, and all the wells that are bored through the clay, have been lowered from eight to fourteen feet, according to their distance from the pump, and all the wells beyond the edge of the clay, near the foot of the hills, have been dried. The principal part of the territory being underlaid by an impervious stratum of clay, except where it is broken up, shows that the actual contributing area is comparatively small; and the quantity of water pumped, compared with the lowering of the water-table, also shows the same thing. The average lowering of the water table, as shown by several wells situated from fifteen hundred to two thousand feet distant, has been above one inch per day. The average quantity of water pumped, up to January 1, has been 438,324 gallons per day. Ordinary water-bearing strata is supposed to contain about twenty-five per cent. of its bulk in water; and one inch in depth over one acre may contain, therefore, 6,788 gallons of water, and sixty-five acres would yield 441,220 gallons, or more than the average amount pumped per day. If the influence of the pumping of the wells reached in all directions alike, and the territory affected was all of a good water-bearing strata, the lowering of the ground-water over that area one inch per day, would indicate a yield of 7,833,467 gallons; but the low yield of the wells conclusively shows the limited extent of the contributing area.

## RESERVOIR.

There has been no outlay at the Reservoir this year, except for cleaning the walk. The bridge from the bank to the gate-house is badly decayed, and will require to be renewed the coming season.

## PUMPING STATION.

The building is in good order and has required no repairs. Some slight repairs have been made to the boilers and furnaces. The engine has received no repairs. It still remains in good condition, and under the careful management of Mr. Messenger, retains its high standard of excellent duty. It has run, during the year, 2,202¼ hours, and has pumped 458,567,880 gallons into the reservoir, at an average height of 166 feet, with an expenditure of 711,750 pounds of coal; an average of 644.15 gallons pumped into the reservoir for each pound of coal consumed. The same necessity exists this year for duplicating the pumping machinery, that has been urged the last two or three years. It is hoped that some decisive action may be taken in this important matter before any serious accident occurs.

## PIPES.

A larger increase has been made to our system of distribution, during the year, than for several years past; 15,771 feet of pipe, from 4 to 10-inch, and 2,936 feet of smaller sizes have been laid in different parts of the city; 33 gates and 30 hydrants have been set in connection with the same; 362 services, and one stand-pipe, for water carts, have been put in, of an aggregate length of 15,439 feet; 13 services have been put in in East Saugus, at the expense of the parties owning the premises. The total length was 331 feet, making a total length of pipe, of all kinds, including distribution and service pipe, laid this year, 34,477 feet, or six and one-half miles.

One hundred and forty-two leaks in pipes, 7 hydrants and 3 gates have been repaired; 14 gate-boxes and 22 service-boxes, found rotten, have been replaced by new ones; 5 leaks in Saugus have been repaired, at the expense of the contractor who put them in. The fire hydrants have received proper attention, and precautions taken to prevent their freezing. So far as can be known all the pipes, gates, and hydrants are in good working order. Annexed please find the usual tables, showing the yearly record of the pumping engine, the consumption of water each month, the rainfall, &c. Also a tabulated statement of the pipe laid, and other work done for the year.

Respectfully submitted,

DANIEL WALDEN,
*Superintendent.*

its bulk in water; and one inch in depth over one acre may contain, therefore, 6,788 gallons of water, and sixty-five acres would yield 441,220 gallons, or more than the average amount pumped per day. If the influence of the pumping of the wells reached in all directions alike, and the territory affected was all of a good water-bearing strata, the lowering of the ground-water over that area one inch per day, would indicate a yield of 7,833,467 gallons; but the low yield of the wells conclusively shows the limited extent of the contributing area.

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# TABLE I.

## ENGINE RECORD FOR THE YEAR ENDING DECEMBER 31, 1880.

| | Number of pumping days. | Average pumping time per day. | | Total pumping time per month. | | Total number of revolutions per month. | Average revolutions per minute. | Coal consumed. | | | | Ashes and cinders. | Ashes and cinders. | Total number of gallons pumped per month, allowing 4 per cent. for loss of action in the pump. | Av'ge number of gals. pumped into the reservoir per lb. of coal. | Average number of gallons raised 100 feet high per pound of coal. | Av'ge head against the pump. | Average duty in pounds of water raised one foot high per 100 lbs. of coal, calculated on the total coal consumed, no deduction being made for ashes and cinders. | Average duty, calculated on the coal consumed, ashes and cinders being deducted. | Average duty calculated on the coal consumed while running, no deduction being made for ashes and cinders. | Average duty calculated on the coal consumed while running, the ashes and cinders deducted. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Raising steam. | Pumping. | Banking. | Total. | | | | | | | | | | |
| Month. | Dys. | H. | M. | H. | M. | Rev'ns. | Rev. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | p. c. | Gallons. | Galls. | Galls. | Feet. | Pounds. | Pounds. | Pounds. | Pounds. |
| January ... | 13 | 15 | 42 | 204 | 05 | 228,690 | 18.67 | 11,300 | 52,300 | 2,400 | 66,000 | 8,000 | 12.12 | 42,662,119 | 646.39 | 1,072.76 | 165.81 | 93,060,357 | 105,896,269 | 117,422,248 | 133,634,681 |
| February .. | 10 | 15 | 37 | 156 | 15 | 176,020 | 18.77 | 8,800 | 40,400 | 1,800 | 51,000 | 6,400 | 12.55 | 32,836,531 | 643.85 | 1,066.64 | 165.67 | 92,615,586 | 105,905,715 | 116,915,715 | 133,689,816 |
| March ..... | 9 | 15 | 51 | 142 | 40 | 159,330 | 18.68 | 8,500 | 36,500 | 1,500 | 46,500 | 5,930 | 12.75 | 29,723,011 | 639.20 | 1,059.47 | 165.76 | 91,996,848 | 105,443,762 | 117,201,464 | 134,333,598 |
| April ...... | 12 | 15 | 38 | 187 | 40 | 210,130 | 18.66 | 10,700 | 48,300 | 2,100 | 61,100 | 7,945 | 13.00 | 39,199,751 | 641.57 | 1,063.85 | 165.82 | 92,372,911 | 106,179,754 | 116,852,689 | 134,316,631 |
| May ....... | 11 | 15 | 39 | 172 | 10 | 192,280 | 18.61 | 9,700 | 43,200 | 2,100 | 55,000 | 7,200 | 13.09 | 35,862,834 | 652.17 | 1,088.78 | 166.18 | 94,104,844 | 108,279,633 | 119,809,408 | 137,855,012 |
| June ....... | 13 | 15 | 38 | 203 | 20 | 227,400 | 18.64 | 11,500 | 52,100 | 2,400 | 66,000 | 8,130 | 12.32 | 42,421,470 | 642.75 | 1,064.52 | 165.62 | 92,428,417 | 105,413,435 | 117,087,822 | 133,534,915 |
| July ....... | 14 | 14 | 57 | 209 | 15 | 235,180 | 18.73 | 11,200 | 53,300 | 3,000 | 67,500 | 9,350 | 13.85 | 43,872,829 | 649.96 | 1,081.05 | 166.33 | 93,867,949 | 108,961,076 | 118,875,920 | 137,989,994 |
| August .... | 12 | 15 | 38 | 187 | 40 | 209,160 | 18.57 | 10,000 | 47,800 | 2,400 | 60,200 | 7,650 | 12.70 | 39,018,798 | 648.15 | 1,078.26 | 166.36 | 93,625,321 | 107,254,888 | 117,913,062 | 135,077,514 |
| September. | 12 | 16 | 01 | 192 | 15 | 209,530 | 18.16 | 10,800 | 48,300 | 2,100 | 61,200 | 7,700 | 12.58 | 39,087,821 | 638.69 | 1,060.73 | 166.08 | 92,100,842 | 105,356,477 | 116,699,201 | 133,495,287 |
| October ... | 13 | 15 | 17 | 198 | 45 | 221,640 | 18.59 | 10,700 | 50,400 | 2,700 | 63,800 | 8,680 | 13.60 | 41,346,942 | 648.07 | 1,076.64 | 166.13 | 93,475,744 | 108,196,164 | 118,328,424 | 136,962,372 |
| November . | 11 | 15 | 05 | 168 | 00 | 185,760 | 18.65 | 9,400 | 42,300 | 2,100 | 53,800 | 7,000 | 13.01 | 34,653,528 | 644.12 | 1,068.98 | 165.96 | 92,813,771 | 106,696,173 | 118,046,829 | 135,700,761 |
| December . | 12 | 15 | 11 | 182 | 15 | 203,030 | 18.56 | 10,700 | 46,850 | 2,100 | 59,650 | 8,280 | 13.88 | 37,875,246 | 634.96 | 1,056.62 | 166.25 | 91,659,488 | 106,421,811 | 116,701,995 | 135,511,648 |
| Tots. & av's | 142 | 15 | 30 | 2202 | 20 | 2,458,150 | 18.60 | 123,300 | 561,750 | 26,700 | 711,750 | 29,265 | 12.98 | 458,567,880 | 644.15 | 1,069.29 | 166.00 | 92,843,506 | 106,667,096 | 117,654,565 | 135,175,186 |

## COST OF PUMPING.

| | | |
|---|---|---|
| 711,750 lbs. of Coal, average price per net ton, $4.93½ | | $1,754 96 |
| 45,650 lbs. of Coal for heating, average price per net ton, $4.54⅜ | | 103 71 |
| 12 cords of Wood, at $4.50 per cord | | 54 00 |
| Oil, Packing and Waste | | 131 72 |
| Sundries | | 19 00 |
| Repairs on Boilers and Furnaces | | 63 10 |
| Wages of Engineer and Fireman | | 1,960 00 |
| | | $4,085 49 |
| Cost of raising one million gallons into the Reservoir | $8.90$\frac{92}{100}$ | |
| Cost of raising one million gallons one foot high | 0.05$\frac{36}{100}$ | |

# TABLE I.

## ENGINE RECORD FOR THE YEAR ENDING DECEMBER 31, 1880.

|  | Number of pumping days. | Average pumping time per day. |  | Total pumping time per month. |  | Total number of revolutions per month. | Average revolutions per minute. | Coal consumed. |  |  |  | Ashes and cinders. | Ashes and cinders. | Total number of gallons pumped per month, allowing 4 per cent. for loss of action in the pump. | Av'ge number of gals. pumped into the reservoir per lb. of coal. | Average number of gallons raised 100 feet high per pound of coal. | Av'ge head against the pump. | Average duty in pounds of water raised one foot high per 100 lbs. of coal, calculated on the total coal consumed, no deduction being made for ashes and cinders. | Average duty, calculated on the coal consumed, ashes and cinders being deducted. | Average duty calculated on the coal consumed while running, no deduction being made for ashes and cinders. | Average duty calculated on the coal consumed while running, the ashes and cinders deducted. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  |  | Raising steam. | Pumping. | Banking. | Total. |  |  |  |  |  |  |  |  |  |  |
| Month. | Dys | H. | M. | H. | M. | Rev'us. | Rev. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | p. c. | Gallons. | Galls. | Galls. | Feet. | Pounds. | Pounds. | Pounds. | Pounds. |
| January ... | 13 | 15 | 42 | 204 | 05 | 228,690 | 18.67 | 11,300 | 52,300 | 2,400 | 66,000 | 8,000 | 12.12 | 42,662,119 | 646.39 | 1,072.76 | 165.81 | 93,060,357 | 105,896,269 | 117,422,248 | 133,634,681 |
| February.. | 10 | 15 | 37 | 156 | 15 | 176,020 | 18.77 | 8,800 | 40,400 | 1,800 | 51,000 | 6,400 | 12.55 | 32,836,531 | 643.85 | 1,066.64 | 165.67 | 92,615,586 | 105,905,715 | 116,915,715 | 133,689,816 |
| March ..... | 9 | 15 | 51 | 142 | 40 | 159,330 | 18.68 | 8,500 | 36,500 | 1,500 | 46,500 | 5,930 | 12.75 | 29,723,011 | 639.20 | 1,059.47 | 165.76 | 91,996,848 | 105,443,762 | 117,201,464 | 134,333,598 |
| April ...... | 12 | 15 | 38 | 187 | 40 | 210,130 | 18.66 | 10,700 | 48,300 | 2,100 | 61,100 | 7,945 | 13.00 | 39,199,751 | 641.57 | 1,063.85 | 165.82 | 92,372,911 | 106,179,754 | 116,852,689 | 134,316,631 |
| May ....... | 11 | 15 | 39 | 172 | 10 | 192,280 | 18.61 | 9,700 | 43,200 | 2,100 | 55,000 | 7,200 | 13.09 | 35,862,834 | 652.17 | 1,083.78 | 166.18 | 94,104,844 | 108,279,633 | 119,809,408 | 137,855,012 |
| June ....... | 13 | 15 | 38 | 203 | 20 | 227,400 | 18.64 | 11,500 | 52,100 | 2,400 | 66,000 | 8,130 | 12.32 | 42,421,470 | 642.75 | 1,064.52 | 165.62 | 92,428,417 | 105,413,435 | 117,087,822 | 133,534,915 |
| July ....... | 14 | 14 | 57 | 209 | 15 | 235,180 | 18.73 | 11,200 | 53,300 | 3,000 | 67,500 | 9,350 | 13.85 | 43,872,829 | 649.96 | 1,081.05 | 166.33 | 93,867,949 | 108,961,076 | 118,875,920 | 137,989,994 |
| August .... | 12 | 15 | 38 | 187 | 40 | 209,160 | 18.57 | 10,000 | 47,800 | 2,400 | 60,200 | 7,650 | 12.70 | 39,018,798 | 648.15 | 1,078.26 | 166.36 | 93,625,321 | 107,254,888 | 117,913,062 | 135,077,514 |
| September. | 12 | 16 | 01 | 192 | 15 | 209,530 | 18.16 | 10,800 | 48,300 | 2,100 | 61,200 | 7,700 | 12.58 | 39,087,821 | 638.69 | 1,060.73 | 166.08 | 92,100,842 | 105,356,477 | 116,699,201 | 133,495,287 |
| October . . . | 13 | 15 | 17 | 198 | 45 | 221,640 | 18.59 | 10,700 | 50,400 | 2,700 | 63,800 | 8,680 | 13.60 | 41,346,942 | 648.07 | 1,076.64 | 166.13 | 93,475,744 | 108,196,164 | 118,328,424 | 136,962,372 |
| November . | 11 | 15 | 05 | 166 | 00 | 185,760 | 18.65 | 9,400 | 42,300 | 2,100 | 53,800 | 7,000 | 13.01 | 34,653,528 | 644.12 | 1,068.98 | 165.96 | 92,813,771 | 106,696,173 | 118,046,829 | 135,700,761 |
| December . | 12 | 15 | 11 | 182 | 15 | 203,030 | 18.56 | 10,700 | 46,850 | 2,100 | 59,650 | 8,280 | 13.88 | 37,875,246 | 634.96 | 1,056.62 | 166.25 | 91,659,488 | 106,421,811 | 116,701,995 | 135,511,648 |
| Tots. & av's | 142 | 15 | 30 | 2202 | 20 | 2,458,150 | 18.69 | 123,300 | 561,750 | 26,700 | 711,750 | 29,265 | 12.98 | 458,567,880 | 644.15 | 1,069.29 | 166.00 | 92,843,506 | 106,667,096 | 117,654,565 | 135,175,186 |

## TABLE III.

### SHOWING THE AMOUNT OF RAINFALL ON THE WATER SHED OF BREED'S AND BIRCH PONDS, AMOUNT OF WATER DRAWN FROM THE PONDS, AMOUNT WASTED FROM THE PONDS, AMOUNT RECEIVED INTO THE PONDS, AND PERCENTAGE OF RAINFALL, AVAILABLE FOR USE, FROM 1874 TO 1880 BOTH INCLUSIVE.

| Date. | Rainfall. | Amount of rainfall on the water shed of the ponds. | Amount of water drawn from the ponds for consumption. | Amount of water wasted from the ponds. | Total amount consumed and wasted in the year. | Increase in ponds during the year. | Decrease in ponds during the year. | Total amount of the rainfall received into the ponds. | Daily average. | Percentage of rainfall received into the ponds. |
|---|---|---|---|---|---|---|---|---|---|---|
| Year. | Inches. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Per ct. |
| 1874 | 34.92 | 837,154,949 | 485,189,801 | 21,200,000 | 506,389,801 | | 47,545,394 | 458,844,407 | 1,257,108 | 54.81 |
| 1875 | 41.85 | 1,003,305,644 | 471,387,757 | 11,609,267 | 482,997,024 | 60,281,293 | | 543,278,317 | 1,488,433 | 54.24 |
| 1876 | 45.05 | 1,080,099,392 | 395,084,629 | 20,500,000 | 415,584,629 | 74,452,111 | | 490,036,740 | 1,342,566 | 45.37 |
| 1877 | 45.65 | 1,094,484,734 | 402,161,193 | 131,271,511 | 533,438,704 | 60,846,704 | | 594,285,408 | 1,628,179 | 54.29 |
| 1878 | 57.36 | 1,379,911,034 | 417,678,296 | 205,081,247 | 622,759,543 | 64,712,199 | | 687,471,742 | 1,883,484 | 49.82 |
| 1879 | 41.04 | 983,957,360 | 456,319,019 | 164,095,022 | 620,414,041 | | 203,370,014 | 417,044,027 | 1,142,586 | 42.38 |
| 1880 | 37.28 | 893,809,219 | 401,905,570 | | 401,905,570 | | 49,803,426 | 352,102,144 | 964,663 | 39.38 |

# TABLE IV.

## SHOWING THE DEPTH OF WATER IN THE PONDS FOR EACH WEEK DURING THE YEAR 1880.

| Date. | | Breed's Pond. | | Birch Pond. | | Date. | | Breed's Pond. | | Birch Pond. | | Date. | | Breed's Pond. | | Birch Pond. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ft. | In. | Ft. | In. | | | Ft. | In. | Ft. | In. | | | Ft. | In. | Ft. | In. |
| Jan. | 3 | 8 | 0 | 10 | 0 | May | 8 | 18 | 10 | 10 | 2 | Sept. | 11 | 12 | 8½ | 8 | 2¼ |
| | 10 | 8 | 10½ | 9 | 11 | | 15 | 18 | 9 | 10 | 4 | | 18 | 12 | 8 | 8 | 3 |
| | 17 | 9 | 10 | 9 | 11 | | 22 | 18 | 8 | 10 | 4½ | | 25 | 12 | 2½ | 8 | 1¼ |
| | 24 | 10 | 10 | 9 | 11 | | 29 | 18 | 3 | 10 | 4 | Oct. | 2 | 11 | 10 | 8 | 1¼ |
| | 31 | 11 | 7½ | 10 | 0 | June | 5 | 18 | 2½ | 9 | 11½ | | 9 | 11 | 4 | 8 | 0 |
| Feb. | 7 | 12 | 1 | 10 | 0 | | 12 | 18 | 1 | 9 | 8½ | | 16 | 10 | 11 | 7 | 11 |
| | 14 | 12 | 10 | 10 | 1 | | 19 | 17 | 10 | 9 | 4 | | 23 | 10 | 8½ | 8 | 0 |
| | 21 | 14 | 0 | 10 | 3½ | | 26 | 17 | 4½ | 9 | 10½ | | 30 | 10 | 6 | 7 | 11¾ |
| | 28 | 14 | 7 | 10 | 2 | July | 3 | 17 | 0 | 8 | 6 | Nov. | 6 | 10 | 1 | 8 | 0 |
| March | 6 | 15 | 3½ | 10 | 3½ | | 10 | 16 | 7 | 8 | 3½ | | 13 | 9 | 9 | 8 | ½ |
| | 13 | 15 | 9 | 10 | 2 | | 17 | 16 | 5 | 8 | 3 | | 20 | 9 | 3 | 7 | 11½ |
| | 20 | 16 | 2½ | 10 | 3 | | 24 | 16 | 6 | 8 | 7 | | 27 | 9 | 2 | 8 | 0 |
| | 27 | 16 | 7 | 10 | 3½ | | 31 | 15 | 11 | 8 | 5½ | Dec. | 4 | 8 | 9 | 7 | 11 |
| April | 3 | 16 | 11 | 10 | 3½ | Aug. | 7 | 15 | 5 | 8 | 6 | | 11 | 8 | 11 | 7 | 11 |
| | 10 | 17 | 3 | 10 | 5½ | | 14 | 14 | 10 | 8 | 5 | | 18 | 8 | 9 | 7 | 10½ |
| | 17 | 17 | 6 | 10 | 3 | | 21 | 14 | 2 | 8 | 3½ | | 25 | 8 | 7½ | 7 | 8½ |
| | 24 | 17 | 8½ | 10 | ½ | | 28 | 13 | 7½ | 8 | 2 | | | | | | |
| May | 1 | 17 | 10½ | 9 | 8½ | Sept. | 4 | 13 | 1 | 8 | 2½ | | | | | | |

## TABLE III.

### SHOWING THE AMOUNT OF RAINFALL ON THE WATER SHED OF BREED'S AND BIRCH PONDS, AMOUNT OF WATER DRAWN FROM THE PONDS, AMOUNT WASTED FROM THE PONDS, AMOUNT RECEIVED INTO THE PONDS, AND PERCENTAGE OF RAINFALL, AVAILABLE FOR USE, FROM 1874 TO 1880 BOTH INCLUSIVE.

| Date. | Rainfall. | Amount of rainfall on the water shed of the ponds. | Amount of water drawn from the ponds for consumption. | Amount of water wasted from the ponds. | Total amount consumed and wasted in the year. | Increase in ponds during the year. | Decrease in ponds during the year. | Total amount of the rainfall received into the ponds. | Daily average. | Percentage of rainfall received into the ponds. |
|---|---|---|---|---|---|---|---|---|---|---|
| Year. | Inches. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Per ct. |
| 1874 | 34.92 | 837,154,949 | 485,189,801 | 21,200,000 | 506,389,801 | | 47,545,394 | 458,844,407 | 1,257,108 | 54.81 |
| 1875 | 41.85 | 1,003,305,644 | 471,387,757 | 11,609,267 | 482,997,024 | 60,281,293 | | 543,278,317 | 1,488,433 | 54.24 |
| 1876 | 45.05 | 1,080,099,392 | 395,084,629 | 20,500,000 | 415,584,629 | 74,452.111 | | 490,036.740 | 1,342,566 | 45.37 |
| 1877 | 45.65 | 1,094,484,734 | 402,161,193 | 131,271,511 | 533,438,704 | 60,846,704 | | 594,285,408 | 1,628,179 | 54.29 |
| 1878 | 57.36 | 1,379,911,034 | 417,678,296 | 205.081.247 | 622,759,543 | 64.712,199 | | 687,471,742 | 1,883,484 | 49.82 |
| 1879 | 41.04 | 983,957,360 | 456.319.019 | 164,095,022 | 620.414,041 | | 203,370,014 | 417.044,027 | 1,142,586 | 42.38 |
| 1880 | 37.28 | 893,809,219 | 401,905,570 | | 401,905,570 | | 49,803,426 | 352,102,144 | 964,663 | 39.38 |

## TABLE IV.

### SHOWING THE DEPTH OF WATER IN THE PONDS FOR EACH WEEK DURING THE YEAR 1880.

| Date. | Breed's Pond. | | Birch Pond. | | Date. | Breed's Pond. | | Birch Pond. | | Date. | Breed's Pond. | | Birch Pond. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ft. | In. | Ft. | In. | | Ft. | In. | Ft. | In. | | Ft. | In. | Ft. | In. |
| Jan. 3 | 8 | 0 | 10 | 0 | May 8 | 18 | 10 | 10 | 2 | Sept. 11 | 12 | 8½ | 8 | 2½ |
| 10 | 8 | 10½ | 9 | 11 | 15 | 18 | 9 | 10 | 4 | 18 | 12 | 8 | 8 | 3 |
| 17 | 9 | 10 | 9 | 11 | 22 | 18 | 8 | 10 | 4½ | 25 | 12 | 2½ | 8 | 1½ |
| 24 | 10 | 10 | 9 | 11 | 29 | 18 | 3 | 10 | 4 | Oct. 2 | 11 | 10 | 8 | 1½ |
| 31 | 11 | 7½ | 10 | 0 | June 5 | 18 | 2½ | 9 | 11½ | 9 | 11 | 4 | 8 | 0 |
| Feb. 7 | 12 | 1 | 10 | 0 | 12 | 18 | 1 | 9 | 8½ | 16 | 10 | 11 | 7 | 11 |
| 14 | 12 | 10 | 10 | 1 | 19 | 17 | 10 | 9 | 4 | 23 | 10 | 8½ | 8 | 0 |
| 21 | 14 | 0 | 10 | 3½ | 26 | 17 | 4½ | 9 | 10½ | 30 | 10 | 6 | 7 | 11¾ |
| 28 | 14 | 7 | 10 | 2 | July 3 | 17 | 0 | 8 | 6 | Nov. 6 | 10 | 1 | 8 | 0 |
| March 6 | 15 | 3½ | 10 | 3½ | 10 | 16 | 7 | 8 | 3½ | 13 | 9 | 9 | 8 | ½ |
| 13 | 15 | 9 | 10 | 2 | 17 | 16 | 5 | 8 | 3 | 20 | 9 | 3 | 7 | 11½ |
| 20 | 16 | 2½ | 10 | 3 | 24 | 16 | 6 | 8 | 7 | 27 | 9 | 2 | 8 | 0 |
| 27 | 16 | 7 | 10 | 3½ | 31 | 15 | 11 | 8 | 5½ | Dec. 4 | 8 | 9 | 7 | 11 |
| April 3 | 16 | 11 | 10 | 3½ | Aug. 7 | 15 | 5 | 8 | 6 | 11 | 8 | 11 | 7 | 11 |
| 10 | 17 | 3 | 10 | 5½ | 14 | 14 | 10 | 8 | 5 | 18 | 8 | 9 | 7 | 10½ |
| 17 | 17 | 6 | 10 | 3 | 21 | 14 | 2 | 8 | 3½ | 25 | 8 | 7½ | 7 | 8½ |
| 24 | 17 | 8½ | 10 | ½ | 28 | 13 | 7½ | 8 | 2 | | | | | |
| May 1 | 17 | 10½ | 9 | 8½ | Sept. 4 | 13 | 1 | 8 | 2½ | | | | | |

# TABLE V.

## SHOWING THE RAINFALL AT THE PUMPING STATION FOR THE YEAR 1880.

| Day of the Month. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .... | .... | .... | .... | .... | .37 | .18 | .... | .... | .... | .... | 1.29 |
| 2 | .... | .16 | .... | .01 | .34 | .03 | .55 | .... | .... | .... | .... | .... |
| 3 | .... | .55 | .35 | .81 | .... | .... | .14 | .55 | .... | .... | .... | .... |
| 4 | .... | .... | .19 | .01 | 1.55 | .... | .... | .68 | .... | .10 | .... | .... |
| 5 | .... | .... | .16 | .... | .... | .... | .11 | .... | .... | .04 | .23 | .56 |
| 6 | .38 | .... | .... | .06 | .... | .05 | .08 | .... | .04 | .... | .28 | .... |
| 7 | .... | .05 | .30 | .... | .... | .06 | .... | .... | .... | .... | .... | .... |
| 8 | .... | .... | .... | .... | .... | .02 | .... | .... | .... | .... | .... | .... |
| 9 | .14 | .... | .07 | .... | .... | .... | .06 | .... | .62 | .... | .... | .... |
| 10 | .... | .06 | .... | .... | .... | .... | .... | .... | .27 | .... | .... | .21 |
| 11 | .... | .12 | .20 | .... | .... | .... | .... | .... | .... | .... | .45 | .... |
| 12 | .63 | .06 | .... | .... | .... | .... | 2.07 | .08 | .... | .06 | .... | .... |
| 13 | .14 | 1.28 | .... | .... | .40 | .04 | .10 | .... | .65 | .... | .... | .... |
| 14 | .... | .... | .07 | .... | .04 | .... | .... | .... | .22 | .... | .... | .40 |
| 15 | .01 | .01 | .27 | .... | .... | .... | .18 | .... | .... | .... | .04 | .... |
| 16 | .... | .... | .30 | .57 | .... | .16 | .59 | .... | .... | .... | .... | .... |
| 17 | .... | .... | .... | .06 | .01 | .... | .... | .... | .02 | .10 | .... | .... |
| 18 | .... | .11 | .... | .... | .28 | .... | .... | .... | .... | .... | .01 | .... |
| 19 | .... | .... | .27 | .01 | .... | .... | .... | .01 | .... | .... | .... | .... |
| 20 | .75 | .... | .... | .06 | .... | .53 | 2.41 | .... | .... | .... | 1.15 | .... |
| 21 | .... | .... | .11 | .... | .... | .... | .... | .05 | .... | .... | .... | .... |
| 22 | .35 | .... | .... | .... | .... | .... | .69 | .... | .... | 1.50 | .... | .... |
| 23 | .08 | .28 | .... | .14 | .... | .... | .02 | .... | .... | .07 | .... | .... |
| 24 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .04 | .... |
| 25 | .... | .... | .... | .... | .... | .... | .... | .07 | .... | .... | .... | .... |
| 26 | .... | .04 | .... | .06 | .... | .... | .... | .... | .... | .... | .... | .17 |
| 27 | .38 | .... | .80 | .... | .... | .... | .04 | .... | .... | .04 | .... | .06 |
| 28 | .... | .63 | .16 | .... | .17 | .06 | .... | .... | .04 | .... | .04 | .01 |
| 29 | .... | .08 | .... | .67 | .... | .01 | .02 | 1.92 | .... | .... | .... | .46 |
| 30 | .01 | .... | .... | .... | .35 | .... | .... | .10 | .... | .73 | .20 | .... |
| 31 | .... | .... | .... | .... | .02 | .... | .... | .... | .... | .01 | .... | .... |
| Totals | 2.84 | 3.43 | 3.25 | 2.46 | 3.16 | 1.33 | 7.24 | 3.46 | 1.86 | 2.65 | 2.44 | 3.16 |

Total rainfall for the year, 37.28 inches.

## TABLE V.

### SHOWING THE RAINFALL AT THE PUMPING STATION FOR THE YEAR 1880.

| Day of the Month. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .... | .... | .... | .... | .... | .37 | .18 | .... | .... | .... | .... | 1.29 |
| 2 | .... | .16 | .... | .01 | .34 | .03 | .55 | .... | .... | .... | .... | .... |
| 3 | .... | .55 | .35 | .81 | .... | .... | .14 | .55 | .... | .... | .... | .... |
| 4 | .... | .... | .19 | .01 | 1.55 | .... | .... | .68 | .... | .10 | .... | .... |
| 5 | .... | .... | .16 | .... | .... | .... | .11 | .... | .... | .04 | .23 | .56 |
| 6 | .38 | .... | .... | .06 | .... | .05 | .08 | .... | .04 | .... | .28 | .... |
| 7 | .... | .05 | .30 | .... | .... | .06 | .... | .... | .... | .... | .... | .... |
| 8 | .... | .... | .... | .... | .... | .02 | .... | .... | .... | .... | .... | .... |
| 9 | .11 | .... | .07 | .... | .... | .... | .06 | .... | .62 | .... | .... | .... |
| 10 | .... | .06 | .... | .... | .... | .... | .... | .... | .27 | .... | .... | .21 |
| 11 | .... | .12 | .20 | .... | .... | .... | .... | .... | .... | .... | .45 | .... |
| 12 | 63 | .06 | .... | .... | .... | .... | 2.07 | .08 | .... | .06 | .... | .... |
| 13 | .14 | 1.28 | .... | .... | .40 | .04 | .10 | .... | .65 | .... | .... | .... |
| 14 | .... | .... | .07 | .... | .04 | .... | .... | .... | .22 | .... | .... | .40 |
| 15 | .01 | .01 | .27 | .... | .... | .... | .18 | .... | .... | .... | .04 | .... |
| 16 | .... | .... | .30 | .57 | .... | .16 | .59 | .... | .... | .... | .... | .... |
| 17 | .... | .... | .... | .06 | .01 | .... | .... | .... | .02 | .10 | .... | .... |
| 18 | .... | .11 | .... | .... | .28 | .... | .... | .... | .... | .... | .01 | .... |
| 19 | .... | .... | .27 | .01 | .... | .... | .... | .01 | .... | .... | .... | .... |
| 20 | .75 | .... | .... | .06 | .... | .53 | 2.41 | .... | .... | .... | 1.15 | .... |
| 21 | .... | .... | .11 | .... | .... | .... | .... | .05 | .... | .... | .... | .... |
| 22 | .35 | .... | .... | .... | .... | .... | .69 | .... | .... | 1.50 | .... | .... |
| 23 | .08 | .28 | .... | .14 | .... | .... | .02 | .... | .... | .07 | .... | .... |
| 24 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .04 | .... |
| 25 | .... | .... | .... | .... | .... | .... | .... | .07 | .... | .... | .... | .... |
| 26 | .... | .04 | .... | .06 | .... | .... | .... | .... | .... | .... | .... | .17 |
| 27 | .38 | .... | .80 | .... | .... | .... | .04 | .... | .... | .04 | .... | .06 |
| 28 | .... | .63 | .16 | .... | .17 | .06 | .... | .... | .04 | .... | .04 | .01 |
| 29 | .... | .08 | .... | .67 | .... | .01 | .02 | 1.92 | .... | .... | .... | .46 |
| 30 | .01 | .... | .... | .... | .35 | .... | .... | .10 | .... | .73 | .20 | .... |
| 31 | .... | .... | .... | .... | .02 | .... | .... | .... | .... | .01 | .... | .... |
| Totals | 2.84 | 3.43 | 3.25 | 2.46 | 3.16 | 1.33 | 7.24 | 3.46 | 1.86 | 2.65 | 2.44 | 3.16 |

**Total rainfall for the year, 37.28 inches.**

# TABLE VI.

## SHOWING THE AMOUNT AND SIZE OF PIPE LAID IN THE YEAR 1880.

| Name of Street. | | | Size of Pipe. | | | |
|---|---|---|---|---|---|---|
| **Street.** | **From.** | **To.** | **10** | **8** | **6** | **4** |
| Mudge ........ | Essex ......... | End of str't | | | 74 | 955.5 |
| Fremont....... | Essex ......... | End of str't | | | 1,015 | |
| | | | | | | 12° C.I |
| Coburn ....... | Essex ......... | End of str't | | | | 777 |
| Empire ....... | Extension ..... | Sewall .... | | | | 310 |
| Dana ......... | Essex ......... | Williams .. | | | | 269 |
| | | | | | | 12° C.I |
| Williams ...... | Dana .......... | Empire.... | | | | 604 |
| Cedar Hill ave.. | Oakwood ave .. | Birch ..... | | | | 564 |
| | | | | | 36° C.I | |
| New Chatham.. | Chatham ..... .. | West'n ave | | | 2,638 | |
| King .......... | Ocean ......... | End of str't | | | | 401 |
| Prescott place.. | Extension ..... | | | | | 144 |
| Western ave ... | Maple ......... | Chestnut .. | 1,549.5 | 12 | 40 | |
| High Rock ave. | High Rock st... | B'c'n H'l av | | | 720.7 | |
| Buffum avenue. | High Rock ave. | | | | 287 | |
| Pleasant St. Ct. | Pleasant ....... | End of Ct . | | | | 744 |
| Wheeler ....... | Pleasant ....... | Church .... | | | | 610.5 |
| Waverly....... | Boston ........ | Bulfinch... | | | | 673 |
| May ........... | Water Hill..... | Hood...... | | | | 1,029.5 |
| Childs ......... | Boston ........ | | | | 514 | |
| Gardiner ...... | Boston ........ | Holyoke... | | | 1,826 | 14 |
| Totals......... | ............... | ........... | 1,549.5 | 12 | 7,114.7 | 7,095.5 |

## TABLE VI.—Continued.

| Name of Court. | | | Size of Pipe. | | | |
|---|---|---|---|---|---|---|
| Court. | From. | To. | 2 | 1 1-2 | 1 1-4 | 1 |
| South-street | South | End of Ct. | 134.5 | 85.2 | | |
| Walnut | Walnut | End of Ct. | 198.8 | 73 | | |
| Perley | Boston | | 303.6 | 109.1 | | |
| Astor-street | Wheeler | | 30.5 | 104.7 | | |
| Blossom-street | Extension | | | | | 58 |
| Saint Stephens | Blossom | End of Ct. | 142.5 | 64.2 | | |
| Northern ave. | Extension | | | 25 | | |
| Shaw's | Essex | End of Ct. | | 221 | | |
| Norcross | Extension | | | | 21.6 | |
| Chestnut | Chestnut | | 202.2 | 85.2 | | |
| Stephens-street | Stephens | | 128.8 | 214.6 | | |
| Stone's Place | Lewis | End of Ct. | 82.0 | 186.6 | | |
| Buffum's Wharf | Broad | Mill | 441.1 | 25.0 | | |
| Totals | | | 1,663.4 | 1.193.2 | 21.6 | 58.0 |

| | | |
|---|---|---|
| Total extension, in 1880 | 3 miles, | 2,867 feet. |
| Previously laid | 52 “ | 1,584 “ |
| Total pipe laid to January 1, 1881 | 55 miles, | 4,451 feet. |
| Total pipe laid in Saugus | 1 mile, | 530 “ |
| “ “ “ Swampscott | | 1,778 “ |
| “ “ “ connection with the Works, | 57 miles, | 1,479 feet. |

## TABLE VII.

### SHOWING THE LOCATION AND SIZE OF GATES SET IN 1880.

| Street. | Location. | Size in Inches. |
|---|---|---|
| Boston | 16 feet 9 inches S. of the N. line of Boston Street.<br>7 feet W. of the W. line of house No. 477 | 8 |
| Boston | 22 feet 5 inches S. of the N. line of Boston Street.<br>6 feet W. of the W. line of house No. 477 | 8 |
| Buffum Ave. | 21 feet 8 inches E. of the W. line of Buffum Ave.<br>1 foot N. of the N. line of High Rock Ave | 6 |
| Childs | 18 feet W. of the E. line of Childs Street.<br>On the line of the N. line of Boston Street | 6 |
| Cedar Hill Ave | 19 feet W. of the E. line of Cedar Hill Ave.<br>On the line of the S. line of Oakwood Ave | 4 |
| Coburn | 28 feet 8 inches E. of the W. line of Coburn Street.<br>On the line of the N. line of Essex Street | 4 |
| Dana | 13 feet 6 inches W. of the E. line of Dana Street.<br>On the line of the S. line of Essex Street | 4 |
| Fremont | 21 feet E. of the W. line of Fremont Street.<br>On the line of the N. line of Essex Street | 6 |
| Gardiner | 25 feet 8 inches W. of the E. line of Gardiner Street.<br>On the line of the N. line of Boston Street | 6 |
| Gardiner | 35 feet 6 inches E. of the W. line of Gardiner Street.<br>1 foot S. of the S. line of Holyoke Street | 6 |
| High Rock | 49 feet S. of the N. line of High Rock Street.<br>2 feet E. of the E. line of High Rock Ave | 6 |
| High Rock Av | 19 feet W. of the E. line of High Rock Ave.<br>12 feet S. of the N. line of High Rock Street | 6 |
| King | 10 feet 6 inches W. of the E. line of King Street.<br>On the line of the S. line of Ocean Street | 4 |
| Mudge | 17 feet 6 inches W. of the E. line of Mudge Street.<br>On the line of the N. line of Cherry Street | 4 |
| May | 16 feet 6 inches W. of the E. line of Allen Street.<br>On the line of the N. line of Hood Street | 4 |
| New Chatham | 17 feet W. of the E. line of New Chatham Street.<br>on line of the point of junction with Chatham St. | 6 |
| New Chatham | 17 ft. 6 in. W. of E. line of New Chatham Street.<br>On line of division line between Nos. 35 and 37 | 6 |
| New Chatham | 18 feet W. of the E. line of New Chatham Street.<br>1 foot 6 inches S. of the S. line of Western Ave. | 6 |
| Pleasant St Ct | 7 feet 6 inches N. of the S. line of Pleasant St. Ct.<br>On the line of the W. line of Pleasant St. | 4 |
| Western Ave. | 28 feet 6 inches S. of the N. line of Western Ave.<br>4 feet W. of the W. line of Chestnut Street | 10 |
| Western Ave. | 18 feet 6 inches S. of the N. line of Western Ave.<br>4 ft. 6 in. E. of W. line of junction of Maple St. | 10 |
| Waverly | 14 feet 6 inches W. of the E. line of Waverly Street.<br>On the line of the N. line of Boston Street | 4 |
| Wheeler | 17 feet 6 inches S. of the N. line of Wheeler Street.<br>1 foot 6 inches W. of W. line of Pleasant Street | 4 |

## TABLE VII. — Continued.

### GATES SET IN COURTS.

| Court. | Location. | Size in inches. |
|---|---|---|
| **Astor St.** | 10 feet 6 inches W. of the E. line of Astor Street.<br>On the line of the S. line of Wheeler Street | 2 |
| **Chestnut St Ct.** | 9 ft. 6 inches N. of the S. line of Chestnut St. Court.<br>On line of the W. line of Chestnut Street | 2 |
| **Perley St.** | 17 feet W. of the E. line of Perley Street.<br>On the line of the N. line of Boston Street | 2 |
| **South St Ct.** | 8 feet N. of the S. line of South Street Court.<br>On the line of the W. line of South Street | 2 |
| **Shaws Ct.** | 7 feet 6 inches W. of the E. line of Shaw's Court.<br>On the line of the S. line of Essex Street | 1½ |
| **Stephens Ct.** | 13 feet E. of the W. line of Stephen's Court.<br>On the line of the S. line of Stephens Street | 2 |
| **St Stephens Ct** | 13 feet 6 inches N. of the S. line St. Stephens Court.<br>6 feet E. of the W. line of Blossom Street | 2 |
| **Walnut Ct.** | 19 feet W. of the E. line of Walnut Court.<br>On the line of the N. line of Walnut Street | 2 |
| **Stones Place.** | 11 feet 6 inches W. of the E. line of Stones Place.<br>2 feet S. of the S. line of Lewis Street | 2 |
| **Buffum's wharf** | 25 ft. 6 in. W. of the W. line of Stmr. House No. 1.<br>7 ft. N. of the S. line of Broad Street | 2 |

**Number of gates set in 1880, 33. Number of gates previously set, 360.**

**Total number of gates set to January 1st, 1881, 393.**

## TABLE VIII.

### SHOWING THE NUMBER AND LOCATION OF HYDRANTS SET IN 1880.

| Street. | Location. |
|---|---|
| **Childs** | **480 feet north of Boston Street.** |
| **Coburn** | **435 feet north of Essex Street.** |
| **Cedar Hill Avenue** | **Corner of Birch Street.** |
| **Empire** | **Corner of Sewall Street.** |
| **Fremont** | **Corner of Fremont Court.** |
| **Fremont** | **Corner of Fremont Place.** |
| **Gardiner** | **420 feet north of Boston Street.** |
| **Gardiner** | **Corner of Florence Street.** |
| **Gardiner** | **470 feet south of Holyoke Street.** |
| **High Rock Avenue** | **Corner of Buffum Avenue.** |
| **King** | **390 feet south of Ocean Street.** |
| **Mudge** | **420 feet north of Cherry Street.** |
| **Mudge** | **100 feet north of Fremont Place.** |
| **May** | **50 feet south of Water Hill Street.** |
| **May** | **50 feet south of Berkley Street.** |
| New Chatham | 470 feet north of the junction of Chatham Street. |
| New Chatham | 970 feet north of the junction of Chatham Street. |
| New Chatham | 50 feet south of Goodrich Street. |
| New Chatham | 380 feet north of Goodrich Street. |
| Pleasant-street Court | 390 feet west of Pleasant Street. |
| Pleasant-street Court | 700 feet west of Pleasant Street. |
| Prescott Place | 500 feet south of Ocean Street. |
| Western Avenue | 90 feet east of Cleveland Street. |
| Western Avenue | 240 feet west of Cleveland Street. |
| Western Avenue | 290 feet east of Maple Street. |
| Williams | Corner of Dana Street. |
| Williams | 130 feet west of Empire Street. |
| Wheeler | 285 feet west of Pleasant Street. |
| Waverly | 300 feet north of Boston Street. |
| Waverly | Corner of Bulfinch Street. |

| | |
|---|---|
| Total number of Hydrants set in 1880 | 30 |
| Previously set | 381 |
| Total number of Hydrants set to January 1, 1880 | 411 |

# TABLE IX.

## SHOWING THE NUMBER OF SERVICE PUT IN, IN 1880.

| Month. | Size of Pipe. | | | | | | | | | | Total. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 inch. | | 1 1-2 inch. | | 1 1-4 inch. | | 1 inch. | | 3-4 inch. | | | |
| | No. | Length. | No. | Length. | No. | Length. | No. | Length. | No. | Length. | No. | Length. |
| January | .... | ........ | .... | ........ | .... | ........ | 3 | 162.7 | 2 | 65.9 | 5 | 228.4 |
| February | .... | ........ | .... | ........ | .... | ........ | .... | ........ | .... | ........ | .... | ........ |
| March | .... | ........ | .... | ........ | .... | ........ | .... | ........ | 4 | 141.0 | 4 | 141.0 |
| April | .... | ........ | .... | ........ | 4 | 732.8 | 2 | 211.2 | 20 | 663.7 | 26 | 1,607.5 |
| May | .... | ........ | .... | ........ | .... | ........ | 5 | 282.1 | 32 | 1,189.9 | 37 | 1,471.10 |
| June | 1 | 32.6 | .... | ........ | 1 | 90.7 | 5 | 485.1 | 29 | 987.5 | 36 | 1,595.7 |
| July | .... | ........ | .... | ........ | .... | ........ | 9 | 621.11 | 26 | 819.8 | 35 | 1,441.7 |
| August | .... | ........ | .... | ........ | 2 | 71.1 | 4 | 506.5 | 42 | 1,701.10 | 48 | 2,279.4 |
| September | .... | ........ | 1 | 80.0 | .... | ........ | 3 | 330.6 | 48 | 1,771.8 | 52 | 2,182.2 |
| October | .... | ........ | .... | ........ | .... | ........ | 1 | 155.3 | 46 | 1,787.4 | 47 | 1,942.7 |
| November | 1 | 18.8 | .... | ........ | .... | ........ | 3 | 216.0 | 50 | 1,711.0 | 54 | 1,945.8 |
| December | 1 | 16.8 | 3 | 103.11 | .... | ........ | 2 | 45.7 | 13 | 437.7 | 19 | 603.9 |
| Totals. | 3 | 67.10 | 4 | 183.11 | 7 | 894.4 | 37 | 3,016.7 | 312 | 11,276.7 | 363 | 15,439.3 |

Length of service pipe laid in 1880............ 2 miles, 4,879 feet.
Length previously laid.........................31 " 3,590 "

Total to January 1, 1881.......................34 " 3,189 "

Laid in Saugus, 1880............ 331.1 feet.
Previously laid.................2,197.7 "

Total to January 1, 1881........2,528.8 "

## METEOROLOGICAL RECORD FOR FEBRUARY, 1880.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.79 | 25° | 73 | 29.74 | 30° | 78 | 29.80 | 18°5 | 26 | 35° | 1°5 | 36°5 | 16°7 | .00 |
| 2 | 30.35 | 0.5 | 39 | 30.40 | 10.5 | 38 | 30.43 | 15 | 63 | 27 | 1 | 28 | 13 | .01 |
| 3 | 30.08 | 27 | 100 | 29.70 | 29.5 | 100 | 29.24 | 32.5 | 95 | 30.5 | 15.5 | 15 | 23 | .43 |
| 4 | 30.59 | 19 | 62 | 29.75 | 26 | 51 | 29.85 | 25 | 62 | 28 | 14.5 | 13.5 | 21.2 | .00 |
| 5 | 30.19 | 16 | 66 | 30.26 | 31 | 68 | 30.28 | 27.5 | 71 | 32.5 | 16 | 16.5 | 24.2 | .00 |
| 6 | 30.26 | 28 | 71 | 30.24 | 34 | 47 | 30.22 | 30 | 78 | 34.5 | 17 | 17.5 | 25.7 | .00 |
| 7 | 30.29 | 19 | 69 | 30.27 | 29.5 | 95 | 30.20 | 26.5 | 87 | 33.5 | 13.5 | 20 | 23.5 | .03 |
| 8 | 30.45 | 13.5 | 82 | 30.45 | 26 | 82 | 30.34 | 26.5 | 70 | 32.5 | 14 | 18.5 | 23.2 | .00 |
| 9 | 29.94 | 32.5 | 70 | 30.07 | 24 | 45 | 30.22 | 16 | 66 | 36.5 | 1 | 35.5 | 18.7 | .00 |
| 10 | 30.44 | 2.5 | 45 | 30.43 | 19.5 | 55 | 30.30 | 26 | 87 | 31.5 | 2.5 | 29 | 17 | .05 |
| 11 | 30.30 | 22 | 93 | 30.39 | 33 | 75 | 30.40 | 32.5 | 70 | 37 | 24 | 13 | 30.5 | .11 |
| 12 | 30.09 | 35.5 | 95 | 29.85 | 45 | 92 | 29.76 | 44.5 | 88 | 47 | 36.5 | 10.5 | 41.7 | .14 |
| 13 | 30.74 | 42 | 100 | 29.66 | 43 | 96 | 29.66 | 39 | 95 | 45.5 | 40 | 5.5 | 42.7 | 1.10 |
| 14 | 29.51 | 41 | 95 | 29.70 | 44.5 | 60 | 29.92 | 36 | 63 | 49 | 31 | 18 | 40 | .00 |
| 15 | 30.10 | 32 | 89 | 30.08 | 32.5 | 84 | 30.04 | 29 | 95 | 32.5 | 27 | 5.5 | 29.7 | .01 |
| 16 | 30.16 | 28 | 88 | 30.29 | 36.5 | 59 | 30.39 | 36.5 | 63 | 40 | 28 | 12 | 34 | .00 |
| 17 | 30.59 | 32.5 | 79 | 30.58 | 46 | 69 | 30.49 | 43 | 71 | 46.5 | 33 | 13.5 | 39.7 | .00 |
| 18 | 30.32 | 43.5 | 87 | 30.16 | 58 | 72 | 29.99 | 51 | 86 | 59 | 31 | 28 | 45 | .05 |
| 19 | 29.93 | 30.5 | 52 | 30.03 | 27 | 76 | 30.05 | 24.5 | 68 | 31 | 14.5 | 16.5 | 22.7 | .00 |
| 20 | 30.22 | 15.5 | 65 | 30.29 | 24 | 43 | 30.22 | 26 | 63 | 29 | 16 | 13 | 22.5 | .00 |
| 21 | 30.09 | 29 | 77 | 29.82 | 37 | 76 | 29.67 | 34 | 71 | 39.5 | 29.5 | 10 | 34.5 | .01 |
| 22 | 29.99 | 29.5 | 73 | 29.91 | 39 | 56 | 29.90 | 34.5 | 71 | 39.5 | 30 | 9.5 | 34.7 | .00 |
| 23 | 29.69 | 34.5 | 90 | 29.51 | 37 | 95 | 29.53 | 34.5 | 76 | 40.5 | 16 | 24.5 | 28.2 | .21 |
| 24 | 29.77 | 16.5 | 67 | 29.97 | 30 | 67 | 30.04 | 29 | 72 | 31 | 17 | 14 | 24 | .00 |
| 25 | 30.15 | 26.5 | 76 | 30.15 | 36 | 63 | 30.05 | 36 | 76 | 41 | 27 | 14 | 34 | .00 |
| 26 | 29.96 | 40 | 82 | 29.92 | 47.5 | 77 | 29.92 | 43.5 | 87 | 48 | 32.5 | 15.5 | 40.2 | .06 |
| 27 | 30.10 | 33.5 | 80 | 30.14 | 51 | 79 | 30.13 | 43.5 | 79 | 51.5 | 34.5 | 17 | 43 | .00 |
| 28 | 30.29 | 38.5 | 86 | 30.25 | 44 | 84 | 30.13 | 47.5 | 73 | 54 | 40 | 14 | 47 | .63 |
| 29 | 29.69 | 53.5 | 93 | 29.58 | 62 | 74 | 29.66 | 54.5 | 41 | 62 | 34.5 | 27.5 | 48.2 | .08 |

| | | | |
|---|---|---|---|
| Monthly range | 68°5 | | |
| Monthly mean | | 30°66 | |
| Monthly rainfall | | | 2.92 |

## METEOROLOGICAL RECORD FOR MARCH, 1880.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.87 | 34°5 | 62 | 29.95 | 37° | 63 | 30.10 | 36°5 | 59 | 39° | 25° | 14° | 32° | .00 |
| 2 | 30.19 | 26.5 | 70 | 30.28 | 36 | 50 | 30.30 | 34 | 52 | 37.5 | 27 | 10.5 | 32.2 | .00 |
| 3 | 30.43 | 31.5 | 84 | 30.27 | 48.5 | 60 | 30.14 | 48.5 | 46 | 51 | 32.5 | 18.5 | 41.7 | .30 |
| 4 | 29.70 | 48.5 | 81 | 29.70 | 57 | 63 | 29.72 | 48 | 77 | 64 | 42.5 | 21.5 | 53.2 | .27 |
| 5 | 29.55 | 43.5 | 92 | 29.28 | 59 | 85 | 29.25 | 62 | 46 | 66 | 32.5 | 33.5 | 49.2 | .06 |
| 6 | 29.84 | 32.5 | 75 | 30.03 | 33 | 70 | 30.12 | 32.5 | 70 | 37 | 29 | 8 | 33 | .00 |
| 7 | 30.31 | 31 | 95 | 30.33 | 36 | 76 | 30.24 | 36.5 | 63 | 38.5 | 33 | 5.5 | 35.7 | .27 |
| 8 | 30.03 | 33.5 | 84 | 30.11 | 32 | 55 | 30.22 | 25.5 | 28 | 35.5 | 16.5 | 19 | 26 | .00 |
| 9 | 30.39 | 21 | 71 | 30.35 | 24.5 | 74 | 30.18 | 25.5 | 87 | 26 | 19 | 7 | 22.5 | .07 |
| 10 | 29.99 | 26 | 68 | 29.96 | 40 | 48 | 30.01 | 35 | 50 | 41.5 | 16 | 25.5 | 28.7 | .00 |
| 11 | 30.31 | 19 | 59 | 30.32 | 24.5 | 87 | 30.31 | 23 | 86 | 24 | 19 | 5 | 21.5 | .14 |
| 12 | 30.37 | 24 | 74 | 30.36 | 36 | 59 | 30.39 | 27 | 42 | 37 | 19 | 18 | 28 | .00 |
| 13 | 30.59 | 21 | 63 | 30.61 | 24.5 | 81 | 30.58 | 24 | 74 | 32 | 22.5 | 9.5 | 27.2 | .00 |
| 14 | 30.41 | 30 | 89 | 30.23 | 37 | 76 | 30.08 | 34.5 | 80 | 40 | 31 | 9 | 35.5 | .10 |
| 15 | 30.25 | 31 | 58 | 30.26 | 39 | 48 | 30.23 | 34.5 | 66 | 40.5 | 32 | 8.5 | 36.2 | .22 |
| 16 | 30.18 | 32.5 | 89 | 30.02 | 35 | 90 | 29.83 | 35 | 95 | 35.5 | 30 | 5.5 | 32.7 | .43 |
| 17 | 29.92 | 30 | 95 | 30.98 | 35 | 58 | 30.01 | 33 | 46 | 36.5 | 23.5 | 13 | 30 | .00 |
| 18 | 30.30 | 25 | 81 | 30.29 | 35 | 62 | 30.21 | 35 | 62 | 36.5 | 23.5 | 13 | 30 | .00 |
| 19 | 30.07 | 35 | 71 | 30.00 | 37.5 | 72 | 29.84 | 32 | 100 | 39.5 | 23.5 | 16 | 31.5 | .19 |
| 20 | 29.82 | 31 | 79 | 29.87 | 42 | 53 | 29.87 | 40.5 | 69 | 45 | 24 | 21 | 34.5 | .24 |
| 21 | 29.91 | 33.5 | 80 | 30.03 | 41.5 | 62 | 30.08 | 39 | 77 | 45.5 | 29.5 | 16 | 37.5 | .00 |
| 22 | 30.08 | 34 | 66 | 29.97 | 49 | 53 | 29.89 | 43 | 75 | 50 | 32 | 18 | 41 | .00 |
| 23 | 29.95 | 34.5 | 66 | 29.93 | 45 | 69 | 29.81 | 43 | 75 | 46.5 | 34 | 12.5 | 40.2 | .00 |
| 24 | 29.57 | 36 | 71 | 29.58 | 32 | 51 | 29.62 | 21.5 | 51 | 37 | 14.5 | 22.5 | 25.7 | .00 |
| 25 | 29.78 | 14.5 | 38 | 29.90 | 26 | 50 | 29.99 | 25 | 56 | 30 | 15 | 15 | 22.5 | .00 |
| 26 | 30.21 | 21 | 23 | 30.23 | 32.5 | 45 | 30.21 | 33 | 46 | 36 | 22 | 14 | 29 | .00 |
| 27 | 30.23 | 29.5 | 51 | 30.14 | 34 | 66 | 29.94 | 32.5 | 95 | 36.5 | 29.5 | 7 | 33 | .51 |
| 28 | 29.47 | 32 | 89 | 29.47 | 30.5 | 95 | 29.53 | 30.5 | 89 | 33 | 27.5 | 5.5 | 30.2 | .04 |
| 29 | 29.78 | 28.5 | 77 | 29.85 | 34.5 | 66 | 29.87 | 33.5 | 70 | 34.5 | 28.5 | 6 | 31.5 | .00 |
| 30 | 29.91 | 29 | 55 | 29.96 | 33.5 | 62 | 29.94 | 35 | 54 | 36 | 28.5 | 7.5 | 32.2 | .00 |
| 31 | 29.87 | 33 | 55 | 29.84 | 42 | 53 | 29.80 | 42 | 50 | 45 | 33.5 | 11.5 | 39.2 | .00 |

| | | | |
|---|---|---|---|
| **Monthly range** ................................ | 51°5 | | |
| **Monthly mean** ................................ | | 33°3 | |
| **Monthly rainfall** ................................ | | | 2.84 |

## METEOROLOGICAL RECORD FOR APRIL, 1880.

| Date. | 8 A. M. | | | 2 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.92 | 40°5 | 52 | 30.00 | 40° | 65 | 30.07 | 40° | 56 | 44° | 35.5 | 8°5 | 39°7 | .00 |
| 2 | 30.24 | 41.5 | 70 | 30.33 | 48 | 46 | 30.25 | 44.5 | 48 | 50 | 41.5 | 8.5 | 45.7 | .05 |
| 3 | 30.31 | 42.5 | 96 | 30.25 | 46 | 96 | 30.12 | 51 | 89 | 56 | 41.5 | 14.5 | 48.7 | .76 |
| 4 | 29.89 | 56 | 75 | 29.92 | 61.5 | 40 | 29.68 | 53.5 | 97 | 63 | 51 | 12 | 57 | .02 |
| 5 | 29.57 | 54 | 67 | 29.60 | 50.5 | 57 | 29.61 | 57 | 58 | 61 | 40 | 21 | 50.5 | .00 |
| 6 | 29.79 | 43.5 | 68 | 29.79 | 51.5 | 63 | 29.67 | 44 | 68 | 60 | 32 | 28 | 46 | .03 |
| 7 | 29.69 | 34 | 70 | 29.78 | 36.5 | 54 | 29.86 | 31 | 63 | 39 | 22.5 | 16.5 | 30.7 | .00 |
| 8 | 30.07 | 26 | 51 | 30.13 | 36 | 63 | 30.10 | 37.5 | 48 | 40 | 27 | 13 | 33.5 | .00 |
| 9 | 30.12 | 34.5 | 58 | 30.06 | 46 | 43 | 29.95 | 41.5 | 58 | 49.5 | 32 | 17.5 | 40.7 | .00 |
| 10 | 29.82 | 42.5 | 66 | 29.72 | 53.5 | 53 | 29.64 | 56.5 | 33 | 57.5 | 42.5 | 15 | 50 | .00 |
| 11 | 29.44 | 44 | 30 | 29.45 | 48 | 29 | 29.57 | 36 | 42 | 48 | 24.5 | 23.5 | 36.2 | .00 |
| 12 | 29.79 | 27 | 52 | 29.83 | 38 | 51 | 29.83 | 37 | 35 | 38.5 | 27.5 | 11 | 33 | .00 |
| 13 | 29.96 | 37 | 63 | 29.78 | 60 | 44 | 29.71 | 59.5 | 46 | 62.5 | 37 | 25.5 | 49.7 | .00 |
| 14 | 29.91 | 43 | 75 | 30.03 | 44.5 | 71 | 30.06 | 39 | 82 | 47.5 | 38 | 9.5 | 42.7 | .00 |
| 15 | 30.03 | 40 | 82 | 29.97 | 49 | 71 | 29.87 | 63 | 65 | 63.5 | 41.5 | 22 | 52.5 | .00 |
| 16 | 30.01 | 56.5 | 51 | 30.05 | 48 | 66 | 30.00 | 40 | 77 | 57 | 37.5 | 19.5 | 47.2 | .41 |
| 17 | 29.78 | 38 | 86 | 29.77 | 36.5 | 90 | 29.81 | 36.5 | 81 | 39 | 35 | 4 | 37 | .04 |
| 18 | 30.09 | 38.5 | 72 | 30.18 | 42 | 66 | 30.24 | 37.5 | 72 | 44 | 37.5 | 6.5 | 40.7 | .00 |
| 19 | 30.31 | 44 | 68 | 30.29 | 49 | 60 | 30.21 | 46 | 65 | 54.5 | 44.5 | 10 | 49.5 | .01 |
| 20 | 30.03 | 54.5 | 90 | 30.05 | 56.5 | 60 | 30.07 | 49 | 77 | 61 | 40.5 | 20.5 | 50.7 | .04 |
| 21 | 30.27 | 48 | 67 | 30.27 | 51.5 | 56 | 30.21 | 54.5 | 53 | 55 | 40 | 15 | 47.5 | .00 |
| 22 | 30.15 | 50 | 58 | 30.05 | 64.5 | 38 | 29.95 | 59 | 40 | 67 | 40.5 | 26.5 | 53.7 | .00 |
| 23 | 30.03 | 42 | 50 | 30.06 | 42.5 | 54 | 30.07 | 42 | 58 | 45 | 36.5 | 8.5 | 40.7 | .13 |
| 24 | 30.11 | 36.5 | 90 | 30.13 | 42 | 74 | 30.11 | 40 | 77 | 45 | 35.5 | 9.5 | 40.2 | .01 |
| 25 | 30.20 | 42.5 | 75 | 30.23 | 45.5 | 57 | 30.18 | 44 | 64 | 47 | 43 | 4 | 45 | .00 |
| 26 | 29.95 | 47 | 85 | 29.74 | 52 | 79 | 29.63 | 59 | 79 | 59.5 | 48 | 11.5 | 53.7 | .04 |
| 27 | 29.73 | 53 | 48 | 29.83 | 59 | 38 | 20.91 | 56.5 | 44 | 61 | 39 | 22 | 50 | .00 |
| 28 | 30.21 | 45 | 32 | 30.25 | 44 | 59 | 30.23 | 50 | 64 | 52 | 43.5 | 8.5 | 47.7 | .00 |
| 29 | 30.31 | 52 | 60 | 30.28 | 63 | 61 | 30.22 | 53.5 | 49 | 64 | 52 | 12 | 58 | .67 |
| 30 | 29.62 | 55 | 87 | 29.58 | 65 | 41 | 30.65 | 52 | 41 | 35 | 34 | 1 | 34.5 | .00 |

| | |
|---|---|
| **Monthly range** ...................................... | **44°5** |
| **Monthly mean** ...................................... | **45°11** |
| **Monthly rainfall.** ...................................... | **2.21** |

## METEOROLOGICAL RECORD FOR MAY, 1880.

| 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 29.95 | 35° | 36 | 30.03 | 43° | 30 | 30.06 | 46°5 | 44 | 49° | 36°5 | 12°5 | 42°7 | .00 |
| 30.08 | 48 | 70 | 30.08 | 50 | 86 | 30.08 | 54 | 71 | 55.5 | 45.5 | 10 | 50.5 | .33 |
| 30.11 | 52.5 | 86 | 30.07 | 65 | 63 | 30.02 | 72 | 49 | 77 | 53.5 | 23.5 | 65.2 | .00 |
| 30.11 | 64 | 67 | 30.13 | 76.5 | 47 | 30.15 | 61 | 77 | 78.5 | 55 | 23.5 | 66.7 | 1.20 |
| 30.13 | 63.5 | 78 | 30.09 | 68 | 84 | 29.98 | 62 | 66 | 69 | 52.5 | 16.5 | 60.7 | .00 |
| 29.71 | 58.5 | 76 | 30.59 | 73.5 | 39 | 29.67 | 64 | 40 | 75 | 43.5 | 31.5 | 59.2 | .00 |
| 30.14 | 45.5 | 57 | 30.19 | 47.5 | 62 | 30.14 | 50 | 75 | 54 | 45.5 | 8.5 | 49.7 | .00 |
| 30.17 | 54 | 71 | 30.17 | 51 | 76 | 30.11 | 56 | 75 | 63 | 45.5 | 17.5 | 54.2 | .00 |
| 30.07 | 62.5 | 86 | 30.00 | 71 | 71 | 29.98 | 72 | 65 | 77.5 | 46 | 31.5 | 61.7 | .00 |
| 30.09 | 54 | 80 | 30.05 | 65 | 68 | 29.99 | 71 | 61 | 82 | 53.5 | 28.5 | 67.7 | .00 |
| 29.96 | 69 | 75 | 29.94 | 78 | 54 | 29.93 | 77 | 41 | 80 | 54.5 | 25.5 | 67.2 | .00 |
| 29.92 | 60.5 | 88 | 29.89 | 66.5 | 50 | 29.82 | 65 | 49 | 69.5 | 43.5 | 26 | 56.5 | .00 |
| 29.84 | 48 | 62 | 29.91 | 51 | 38 | 30.00 | 48 | 77 | 52.5 | 40.5 | 12 | 46.5 | .37 |
| 30.19 | 44.5 | 68 | 30.24 | 51.5 | 46 | 30.26 | 49 | 60 | 53 | 39.5 | 13.5 | 46.2 | .02 |
| 30.27 | 49 | 40 | 30.25 | 51 | 49 | 30.18 | 52 | 53 | 58.5 | 47 | 11.5 | 52.7 | .00 |
| 30.14 | 57.5 | 40 | 30.09 | 64 | 36 | 30.01 | 64.5 | 46 | 66.5 | 48 | 18.5 | 57.2 | .00 |
| 29.90 | 56 | 75 | 29.81 | 76.5 | 40 | 29.85 | 69 | 52 | 8[illegible].5 | 48 | 33.5 | 64.7 | .00 |
| 30.05 | 53.5 | 70 | 30.09 | 52.5 | 77 | 30.10 | 51 | 86 | 56 | 47.5 | 8.5 | 51.7 | .26 |
| 30.22 | 48.5 | 85 | 30.21 | 52.5 | 83 | 30.25 | 54 | 86 | 64 | 49 | 15 | 56.5 | .01 |
| 30.07 | 64 | 78 | 30.05 | 70.5 | 73 | 30.00 | 73 | 46 | 75.5 | 58 | 17.5 | 66.7 | .00 |
| 30.1[illegible] | 65.5 | 78 | 30.11 | 78 | 65 | 30.13 | 73 | 65 | 79 | 58.5 | 20.5 | 68.7 | .00 |
| 30.27 | 69 | 77 | 30.25 | 74 | 68 | 30.23 | 69 | 75 | 74 | 60 | 14 | 67 | .00 |
| 30.24 | 63.5 | 91 | 30.21 | 68.5 | 79 | 30.18 | 66.5 | 84 | 70.5 | 59 | 11.5 | 64.7 | .00 |
| 30.16 | 69 | 75 | 30.09 | 80.5 | 55 | 30.05 | 82.5 | 60 | 85 | 63.5 | 21.5 | 74.2 | .00 |
| 30.11 | 64 | 73 | 30.09 | 67 | 74 | 30.00 | 68 | 74 | 78.5 | 64.5 | 14 | 71.5 | .00 |
| 30.01 | 78.5 | 71 | 30.00 | 81 | 68 | 29.91 | 78 | 66 | 85 | 64.5 | 20.5 | 74.7 | .00 |
| 29.92 | 80 | 66 | 29.89 | 87.5 | 57 | 29.83 | 88 | 53 | 90 | 69 | 21 | 79.5 | .00 |
| 29.83 | 77.5 | 60 | 29.85 | 84 | 57 | 29.89 | 69 | 75 | 85 | 56.5 | 28.5 | 70.7 | .14 |
| 30.17 | 61.5 | 58 | 30.21 | 62.5 | 67 | 30.21 | 64 | 70 | 66.5 | 54 | 12.5 | 60.2 | .00 |
| 30.26 | 57.5 | 75 | 30.23 | 56.5 | 78 | 30.13 | 52.5 | 93 | 64 | 52 | 12 | 58 | .31 |
| 29.86 | 64 | 94 | 29.86 | 76 | 64 | 29.90 | 75 | 66 | 77.5 | 59.5 | 18 | 68.5 | .03 |

| | |
|---|---|
| **Monthly range** | 63°5 |
| **Monthly mean** | 61°39 |
| **Monthly rainfall** | 2.67 |

## METEOROLOGICAL RECORD FOR JUNE, 1880.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.97 | 69°5 | 68 | 29.97 | 81° | 55 | 30.01 | 71° | 57 | 82°5 | 49° | 33°5 | 65°7 | .33 |
| 2 | 30.10 | 51 | 86 | 30.11 | 56 | 75 | 30.09 | 59 | 73 | 59.5 | 48.5 | 11 | 54 | .01 |
| 3 | 30.15 | 59.5 | 68 | 30.18 | 59.5 | 71 | 30.19 | 55.5 | 78 | 63 | 52.5 | 10.5 | 57.7 | .00 |
| 4 | 30.25 | 57.5 | 75 | 30.30 | 56 | 75 | 30.32 | 54 | 80 | 60 | 49 | 11 | 54.5 | .00 |
| 5 | 30.34 | 57 | 82 | 30.32 | 61 | 71 | 30.25 | 65.5 | 71 | 67.5 | 56 | 11.5 | 61.7 | .02 |
| 6 | 30.17 | 61 | 83 | 30.07 | 66 | 87 | 29.99 | 62.5 | 97 | 68 | 59.5 | 8.5 | 63.7 | .03 |
| 7 | 29.94 | 62 | 88 | 29.97 | 66 | 89 | 29.95 | 57.5 | 100 | 66.5 | 49 | 17.5 | 57.7 | .08 |
| 8 | 30.17 | 52 | 96 | 30.22 | 53 | 97 | 30.21 | 52 | 89 | 54.5 | 50 | 4.5 | 52.2 | .02 |
| 9 | 30.27 | 52.5 | 86 | 30.27 | 60 | 73 | 30.25 | 61.5 | 74 | 62.5 | 48.5 | 14 | 55.5 | .00 |
| 10 | 30.24 | 59.5 | 68 | 30.21 | 61 | 74 | 30.17 | 63.5 | 80 | 66 | 56.5 | 9.5 | 61.2 | .00 |
| 11 | 30.10 | 66 | 78 | 30.05 | 78 | 65 | 29.95 | 75 | 77 | 80.5 | 65 | 15.5 | 72.7 | .00 |
| 12 | 29.75 | 74.5 | 75 | 29.76 | 84 | 47 | 29.70 | 76 | 66 | 83 | 62.5 | 20.5 | 72.7 | .00 |
| 13 | 29.71 | 68.5 | 60 | 29.63 | 77 | 55 | 29.53 | 79 | 60 | 80.5 | 58.5 | 22 | 69.5 | .02 |
| 14 | 29.62 | 63 | 62 | 29.67 | 69 | 52 | 29.78 | 64.5 | 65 | 70.5 | 56.5 | 14 | 63.5 | .00 |
| 15 | 29.91 | 65 | 59 | 29.92 | 64 | 53 | 29.91 | 63.5 | 65 | 70.5 | 52 | 18.5 | 61.2 | .00 |
| 16 | 29.99 | 66 | 59 | 30.02 | 68 | 56 | 30.01 | 68 | 67 | 71.5 | 53.5 | 18 | 62.5 | .12 |
| 17 | 30.11 | 61.5 | 80 | 30.15 | 66.5 | 68 | 30.17 | 68 | 69 | 69.5 | 56.5 | 13 | 63 | .00 |
| 18 | 30.25 | 66.5 | 71 | 30.27 | 69.5 | 68 | 30.25 | 72 | 71 | 73 | 57.5 | 15.5 | 65.2 | .00 |
| 19 | 30.27 | 68.5 | 72 | 30.24 | 80 | 58 | 30.20 | 76 | 71 | 81 | 60.5 | 20.5 | 70.7 | .00 |
| 20 | 30.15 | 69 | 75 | 30.08 | 80.5 | 60 | 29.97 | 78 | 71 | 84 | 61 | 23 | 72.5 | .25 |
| 21 | 29.87 | 70 | 75 | 29.79 | 78.5 | 65 | 29.72 | 76.5 | 71 | 69.5 | 55 | 14.5 | 62.2 | .01 |
| 22 | 29.80 | 62 | 66 | 29.79 | 66 | 55 | 29.80 | 69 | 54 | 68.5 | 54.5 | 14 | 61.5 | .00 |
| 23 | 29.92 | 61.5 | 74 | 29.90 | 74.5 | 56 | 29.91 | 74 | 63 | 75 | 55 | 20 | 65 | .00 |
| 24 | 29.92 | 71.5 | 76 | 29.79 | 75 | 62 | 29.84 | 78 | 65 | 79 | 65 | 14 | 72 | .00 |
| 25 | 29.92 | 74 | 77 | 29.93 | 73 | 72 | 29.87 | 77 | 67 | 78 | 68 | 10 | 73 | .00 |
| 26 | 29.88 | 76 | 71 | 29.88 | 86 | 54 | 29.87 | 86 | 54 | 87.5 | 68.5 | 19 | 78 | .00 |
| 27 | 30.02 | 78 | 56 | 29.99 | 85.5 | 43 | 29.98 | 77.5 | 57 | 86 | 66.5 | 19.5 | 76.2 | .00 |
| 28 | 29.90 | 75 | 68 | 29.79 | 80 | 72 | 29.73 | 82 | 71 | 85 | 72 | 13 | 78.5 | .06 |
| 29 | 29.80 | 78 | 69 | 29.84 | 85.5 | 54 | 29.87 | 85 | 52 | 88 | 68 | 20 | 78 | .00 |
| 30 | 29.90 | 76 | 77 | 29.90 | 84 | 57 | 29.95 | 81.5 | 51 | 84.5 | 63.5 | 21 | 74 | .00 |

Monthly range ..................................39°5
Monthly mean.................................. 65°88
Monthly rainfall.............. ................. .95

## METEOROLOGICAL RECORD FOR JULY, 1880.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.11 | 74° | 59 | 30.09 | 82° | 49 | 30.04 | 83° | 67 | 85°5 | 65° | 20°5 | 75°2 | .15 |
| 2 | 29.90 | 65.5 | 87 | 29.84 | 63 | 100 | 29.77 | 62 | 97 | 65.5 | 60.5 | 5 | 63 | .54 |
| 3 | 29.81 | 61 | 94 | 29.84 | 64.5 | 86 | 29.88 | 65.5 | 87 | 67.5 | 60.5 | 7 | 64 | .31 |
| 4 | 29.91 | 66 | 81 | 30.03 | 73.5 | 68 | 30.03 | 73 | 67 | 74 | 62 | 12 | 68 | .00 |
| 5 | 30.06 | 73 | 70 | 30.02 | 82.5 | 56 | 30.00 | 74.5 | 91 | 83.5 | 65.5 | 18 | 74.5 | .11 |
| 6 | 29.91 | 69 | 100 | 29.92 | 75.5 | 79 | 29.90 | 73.5 | 81 | 77 | 68 | 9 | 72.5 | .00 |
| 7 | 30.03 | 74 | 79 | 30.06 | 75 | 73 | 30.05 | 75.5 | 73 | 77.5 | 63 | 14.5 | 70.2 | .00 |
| 8 | 30.18 | 76 | 62 | 30.18 | 77.5 | 37 | 30.13 | 77 | 49 | 78 | 68 | 10 | 73 | .00 |
| 9 | 30.08 | 75 | 62 | 29.99 | 81 | 78 | 29.89 | 79.5 | 78 | 84 | 71 | 13 | 77.5 | .04 |
| 10 | 29.86 | 79 | 74 | 29.85 | 87 | 55 | 29.81 | 84 | 64 | 89.5 | 71 | 18.5 | 80.2 | .00 |
| 11 | 29.99 | 72.5 | 54 | 30.03 | 74.5 | 46 | 30.04 | 73.5 | 54 | 76.5 | 60 | 16.5 | 68.2 | .00 |
| 12 | 30.20 | 67 | 68 | 30.20 | 70 | 66 | 30.10 | 72.5 | 65 | 73 | 62.5 | 10.5 | 67.7 | 1.72 |
| 13 | 29.81 | 66.5 | 94 | 29.18 | 69 | 84 | 29.85 | 69.5 | 77 | 76 | 57 | 19 | 66.5 | .07 |
| 14 | 29.98 | 63.5 | 80 | 30.03 | 65.5 | 63 | 30.02 | 66 | 59 | 69 | 62 | 7 | 65.5 | .00 |
| 15 | 29.99 | 68 | 79 | 29.93 | 70.5 | 62 | 29.87 | 66.5 | 92 | 71 | 65 | 6 | 68 | .16 |
| 16 | 29.82 | 66 | 94 | 29.75 | 67.5 | 92 | 29.66 | 73 | 85 | 68.5 | 64.5 | 4 | 66.5 | .34 |
| 17 | 29.74 | 71 | 75 | 29.76 | 77 | 55 | 29.81 | 78.5 | 60 | 79.5 | 61.5 | 18 | 70.5 | .00 |
| 18 | 30.00 | 69.5 | 66 | 30.04 | 76.5 | 61 | 30.05 | 73 | 61 | 76.5 | 62 | 14.5 | 69.2 | .00 |
| 19 | 30.14 | 73 | 72 | 30.14 | 73.5 | 70 | 30.10 | 72 | 67 | 76 | 61 | 15 | 68.5 | .00 |
| 20 | 30.10 | 65 | 89 | 30.05 | 66 | 92 | 29.99 | 65 | 94 | 73 | 64 | 9 | 68.5 | 1.39 |
| 21 | 30.04 | 73 | 90 | 30.08 | 74 | 83 | 30.08 | 72 | 85 | 72 | 66 | 6 | 69 | .02 |
| 22 | 30.16 | 68.5 | 72 | 30.17 | 73 | 70 | 30.14 | 69.5 | 84 | 74 | 61 | 13 | 67.5 | .83 |
| 23 | 30.10 | 63 | 91 | 30.15 | 69 | 84 | 30.14 | 68 | 89 | 71 | 63.5 | 7.5 | 67.2 | .03 |
| 24 | 30.13 | 69 | 84 | 30.12 | 76 | 75 | 30.08 | 74 | 81 | 76 | 62.5 | 13.5 | 69.2 | .00 |
| 25 | 30.08 | 71.5 | 85 | 30.09 | 75.5 | 73 | 30.07 | 76.5 | 77 | 78 | 68 | 10 | 73 | .00 |
| 26 | 30.02 | 72 | 74 | 30.01 | 77 | 73 | 30.00 | 76 | 77 | 79 | 67 | 12 | 73 | .00 |
| 27 | 30.00 | 73 | 81 | 30.01 | 81 | 66 | 29.99 | 76 | 64 | 82.5 | 60 | 22.5 | 71.2 | .05 |
| 28 | 30.03 | 64 | 73 | 30.02 | 71 | 60 | 30.00 | 71 | 59 | 73 | 50 | 23 | 61.5 | .00 |
| 29 | 29.97 | 60 | 76 | 29.94 | 68 | 60 | 29.94 | 65 | 78 | 69 | 50.5 | 18.5 | 59.7 | .02 |
| 30 | 29.96 | 59 | 82 | 29.98 | 70.5 | 83 | 29.98 | 73.5 | 59 | 73.5 | 51 | 22.5 | 62.2 | .00 |
| 31 | 30.11 | 63 | 88 | 30.12 | 78.5 | 57 | 30.10 | 80 | 64 | 82.5 | 65.5 | 17 | 74 | .00 |

**Monthly range** ................................39°5
**Monthly mean** ................................ 69°20
**Monthly rainfall** ................................ 5.78

## METEOROLOGICAL RECORD FOR AUGUST, 1880.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.14 | 74°5 | 72 | 30.12 | 83°5 | 57 | 30.08 | 84°5 | 61 | 86°5 | 66°5 | 20° | 76°5 | .00 |
| 2 | 30.02 | 74 | 77 | 29.96 | 80 | 74 | 29.89 | 78.5 | 78 | 83 | 70 | 13 | 76.5 | .00 |
| 3 | 29.97 | 78 | 73 | 30.00 | 73.5 | 83 | 30.05 | 62 | 100 | 79 | 61 | 18 | 70 | .49 |
| 4 | 30.07 | 63 | 100 | 30.04 | 73 | 85 | 30.05 | 62.5 | 100 | 75.5 | 61.5 | 14 | 68.5 | .64 |
| 5 | 30.15 | 64 | 94 | 30.16 | 72 | 67 | 30.17 | 68 | 89 | 72.5 | 57 | 15.5 | 64.7 | .01 |
| 6 | 30.21 | 64 | 45 | 30.20 | 70.5 | 68 | 30.17 | 67.5 | 76 | 71.5 | 59 | 12.5 | 65.2 | .00 |
| 7 | 30.19 | 67 | 76 | 30.21 | 74 | 68 | 30.19 | 74.5 | 68 | 76 | 60 | 16 | 68 | .00 |
| 8 | 30.20 | 69.5 | 75 | 30.19 | 72.5 | 78 | 30.17 | 69.5 | 88 | 75 | 63.5 | 11.5 | 69.2 | .00 |
| 9 | 30.05 | 69.5 | 84 | 29.95 | 81 | 66 | 29.91 | 80 | 68 | 82.5 | 66 | 16.5 | 74.2 | .00 |
| 10 | 29.90 | 72.5 | 80 | 29.89 | 82 | 69 | 29.88 | 75 | 79 | 84 | 53 | 31 | 68.5 | .00 |
| 11 | 30.00 | 67.5 | 84 | 30.00 | 73 | 72 | 30.04 | 72 | 85 | 73.5 | 63.5 | 10 | 68.5 | .00 |
| 12 | 30.08 | 68.5 | 82 | 30.09 | 75 | 68 | 30.06 | 70 | 79 | 77.5 | 58.5 | 19 | 68 | .00 |
| 13 | 30.05 | 66.5 | 79 | 30.00 | 77 | 61 | 29.96 | 75 | 60 | 78.5 | 61.5 | 17 | 70 | .00 |
| 14 | 29.81 | 70.5 | 73 | 29.75 | 75 | 73 | 29.73 | 72 | 80 | 76.5 | 57.5 | 19 | 67 | .00 |
| 15 | 29.88 | 61.5 | 72 | 29.94 | 63.5 | 72 | 30.02 | 63.5 | 64 | 67 | 47 | 20 | 57 | .01 |
| 16 | 30.29 | 54.5 | 74 | 30.32 | 63 | 69 | 30.34 | 62 | 72 | 64 | 49.5 | 14.5 | 56.7 | .00 |
| 17 | 30.43 | 57 | 78 | 30.41 | 69.5 | 66 | 30.38 | 64.5 | 75 | 70.5 | 52.5 | 18 | 61.5 | .00 |
| 18 | 30.35 | 64 | 78 | 30.33 | 69 | 74 | 30.28 | 69 | 70 | 71.5 | 55.5 | 16 | 63.5 | .00 |
| 19 | 30.17 | 63 | 88 | 30.05 | 74 | 68 | 29.95 | 71 | 80 | 74 | 64.5 | 9.5 | 69.2 | .01 |
| 20 | 29.78 | 70 | 90 | 29.73 | 77.5 | 80 | 29.72 | 77 | 80 | 81 | 67 | 14 | 74 | .01 |
| 21 | 29.74 | 71.5 | 92 | 29.72 | 79 | 91 | 29.70 | 76.5 | 88 | 81.5 | 62 | 19.5 | 71.7 | .06 |
| 22 | 29.95 | 68 | 76 | 29.98 | 78.5 | 62 | 29.99 | 77.5 | 75 | 80.5 | 62 | 18.5 | 71.2 | .00 |
| 23 | 30.13 | 71.5 | 80 | 30.16 | 81 | 57 | 30.15 | 80 | 64 | 84 | 67 | 17 | 75.5 | .00 |
| 24 | 30.18 | 75 | 81 | 30.14 | 81 | 66 | 30.05 | 76.5 | 75 | 82 | 72 | 10 | 77 | .00 |
| 25 | 30.00 | 75 | 85 | 30.05 | 70 | 88 | 30.11 | 65 | 89 | 75 | 49.5 | 25.5 | 62.2 | .05 |
| 26 | 30.32 | 55 | 74 | 30.33 | 59 | 59 | 30.30 | 58 | 70 | 61.5 | 47 | 14.5 | 54.2 | .00 |
| 27 | 30.30 | 56 | 75 | 30.30 | 60.5 | 68 | 30.24 | 61 | 83 | 66 | 56.5 | 9.5 | 61.2 | .00 |
| 28 | 30.17 | 66 | 81 | 30.09 | 77 | 73 | 30.05 | 78 | 73 | 82 | 66 | 16 | 74 | .00 |
| 29 | 30.06 | 76 | 81 | 30.05 | 74.5 | 77 | 30.12 | 66.5 | 81 | 83 | 59 | 24 | 71 | 1.82 |
| 30 | 30.23 | 59 | 91 | 30.25 | 62. | 77 | 30.22 | 60 | 76 | 63 | 52 | 11 | 57.5 | .09 |
| 31 | 30.27 | 58.5 | 90 | 30.28 | 66 | 64 | 30.26 | 63 | 83 | 66 | 52 | 14 | 59 | .00 |

| | | | |
|---|---|---|---|
| Monthly range | 39°5 | | |
| Monthly mean | | 67°47 | |
| Monthly rainfall. | | | 3.19 |

## METEOROLOGICAL RECORD FOR SEPTEMBER, 1880.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.25 | 60° | 85 | 30.26 | 67° | 68 | 30.24 | 64° | 83 | 67° | 60° | 7° | 63°5 | .00 |
| 2 | 30.25 | 63 | 88 | 30.21 | 72 | 69 | 30.17 | 70 | 77 | 72.5 | 60 | 12.5 | 66.2 | .00 |
| 3 | 30.10 | 68 | 84 | 30.03 | 79 | 74 | 29.98 | 76 | 86 | 81.5 | 66 | 15.5 | 73.7 | .00 |
| 4 | 29.92 | 72 | 85 | 29.88 | 78 | 80 | 29.83 | 77.5 | 84 | 79.5 | 69 | 10.5 | 74.2 | .00 |
| 5 | 29.89 | 76.5 | 82 | 29.90 | 84.5 | 64 | 29.90 | 82.5 | 71 | 87 | 65 | 22 | 76 | .00 |
| 6 | 29.93 | 73 | 72 | 29.90 | 82.5 | 61 | 29.86 | 79 | 70 | 86 | 63 | 23 | 74.5 | .03 |
| 7 | 29.94 | 64 | 87 | 29.97 | 69.5 | 66 | 29.96 | 65 | 80 | 70 | 57 | 13 | 63.5 | .00 |
| 8 | 30.10 | 57 | 72 | 30.12 | 60 | 66 | 30.07 | 59 | 82 | 61.5 | 56.5 | 5 | 59 | .00 |
| 9 | 30.13 | 57.5 | 87 | 30.14 | 60.5 | 77 | 30.11 | 58 | 82 | 61 | 53 | 8 | 57 | .62 |
| 10 | 29.98 | 53 | 97 | 29.96 | 52.5 | 100 | 30.02 | 55 | 78 | 56 | 49 | 7 | 52.5 | .12 |
| 11 | 30.24 | 55 | 75 | 30.24 | 69 | 58 | 30.23 | 67.5 | 72 | 72.5 | 52 | 20.5 | 62.2 | .00 |
| 12 | 30.25 | 60.5 | 83 | 30.22 | 67 | 71 | 30.17 | 64 | 72 | 67 | 55 | 12 | 61 | .00 |
| 13 | 30.04 | 64 | 88 | 29.96 | 71 | 62 | 29.90 | 64 | 86 | 73.5 | 55 | 18.5 | 64.2 | .59 |
| 14 | 29.87 | 56 | 90 | 29.85 | 57.5 | 90 | 29.84 | 56 | 93 | 58.5 | 52.5 | 6 | 55.5 | .16 |
| 15 | 29.72 | 56 | 90 | 29.76 | 59 | 82 | 29.80 | 58 | 87 | 61.5 | 51.5 | 10 | 56.5 | .00 |
| 16 | 29.83 | 55 | 90 | 29.81 | 67.5 | 69 | 29.84 | 64 | 83 | 68.5 | 53.5 | 15 | 61 | .00 |
| 17 | 29.96 | 59.5 | 85 | 29.96 | 71 | 62 | 29.97 | 68.5 | 77 | 74 | 57.5 | 16.5 | 65.7 | .00 |
| 18 | 30.06 | 61 | 83 | 30.07 | 77 | 74 | 30.09 | 62 | 83 | 67.5 | 56.5 | 11 | 62 | .00 |
| 19 | 30.23 | 62.5 | 80 | 30.24 | 65 | 71 | 30.23 | 62 | 83 | 72 | 61 | 11 | 66.5 | .00 |
| 20 | 30.17 | 61.5 | 91 | 30.80 | 69 | 84 | 30.01 | 71 | 83 | 74 | 62 | 12 | 68 | .00 |
| 21 | 29.94 | 67 | 68 | 29.93 | 71 | 80 | 29.91 | 67 | 62 | 72.5 | 52 | 20.5 | 62.2 | .00 |
| 22 | 30.18 | 56.5 | 66 | 30.20 | 63 | 57 | 30.20 | 61 | 63 | 65 | 46 | 19 | 55.5 | .00 |
| 23 | 30.23 | 48 | 77 | 30.24 | 59 | 59 | 30.35 | 57 | 75 | 62 | 42 | 20 | 52 | .00 |
| 24 | 30.35 | 49 | 85 | 30.35 | 62 | 72 | 30.30 | 60 | 85 | 66.5 | 49 | 17.5 | 57.7 | .00 |
| 25 | 30.27 | 55 | 90 | 30.25 | 68 | 72 | 30.21 | 65.5 | 84 | 71.5 | 52.5 | 19 | 62 | .00 |
| 26 | 30.34 | 57.5 | 97 | 30.19 | 71 | 53 | 30.16 | 64.5 | 97 | 72 | 58 | 14 | 65 | .00 |
| 27 | 30.05 | 63 | 100 | 29.95 | 75 | 77 | 29.92 | 69.5 | 87 | 75.5 | 63 | 12.5 | 69.2 | .00 |
| 28 | 29.80 | 65.5 | 97 | 29.68 | 72 | 88 | 29.60 | 70 | 90 | 75.5 | 49.5 | 26 | 62.5 | .01 |
| 29 | 29.83 | 53.5 | 89 | 29.80 | 68 | 53 | 29.85 | 61.5 | 66 | 69 | 45 | 24 | 57 | .00 |
| 30 | 30.00 | 49.5 | 82 | 30.03 | 62.5 | 59 | 30.08 | 56 | 63 | 63 | 41.5 | 21.5 | 52.2 | .00 |

Monthly range.................................45°5
Monthly mean........ ............................ 62.61
Monthly rainfall................................. 1.53

## METEOROLOGICAL RECORD FOR AUGUST, 1[illegible].

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.14 | 74.5 | 72 | 30.12 | 85.5 | 57 | 30.08 | 84.5 | 61 | 86.5 | 66.5 | 20° | 76°.5 | .00 |
| 2 | 30.02 | 74 | 77 | 29.96 | 80 | 74 | 29.89 | 78.5 | 78 | 83 | 70 | 13 | 76.5 | .00 |
| 3 | 29.97 | 78 | 73 | 30.00 | 73.5 | 83 | 30.06 | 62 | 100 | 79 | 61 | 18 | 70 | .49 |
| 4 | 30.07 | 63 | 100 | 30.04 | 73 | 85 | 30.05 | 62.5 | 100 | 75.5 | 61.5 | 14 | 68.5 | .64 |
| 5 | 30.15 | 64 | 94 | 30.16 | 72 | 67 | 30.17 | 68 | 89 | 72.5 | 57 | 15.5 | 64.7 | .01 |
| 6 | 30.21 | 64 | 45 | 30.20 | 70.5 | 68 | 30.17 | 67.5 | 76 | 71.5 | 59 | 12.5 | 65.2 | .00 |
| 7 | 30.19 | 67 | 76 | 30.21 | 74 | 68 | 30.19 | 74.5 | 68 | 76 | 60 | 16 | 68 | .00 |
| 8 | 30.20 | 69.5 | 75 | 30.19 | 72.5 | 78 | 30.17 | 69.5 | 88 | 75 | 63.5 | 11.5 | 69.2 | .00 |
| 9 | 30.05 | 69.5 | 84 | 29.95 | 81 | 65 | 29.91 | 80 | 66 | 82.5 | 66 | 16.5 | 74.2 | .00 |
| 10 | 29.90 | 72.5 | 80 | 29.89 | 82 | 69 | 29.88 | 75 | 79 | 84 | 53 | 31 | 68.5 | .00 |
| 11 | 30.00 | 67.5 | 84 | 30.00 | 73 | 72 | 30.04 | 72 | 85 | 73.5 | 63.5 | 10 | 68.5 | .00 |
| 12 | 30.08 | 65.5 | 82 | 30.09 | 78 | 68 | 30.06 | 70 | 79 | 77.5 | 58.5 | 19 | 68 | .00 |
| 13 | 30.05 | 66.5 | 79 | 30.00 | 77 | 61 | 29.96 | 75 | 60 | 78.5 | 61.5 | 17 | 70 | .00 |
| 14 | 29.81 | 70.5 | 73 | 29.75 | 75 | 73 | 29.73 | 72 | 80 | 76.5 | 57.5 | 19 | 67 | .00 |
| 15 | 29.88 | 61.5 | 72 | 29.94 | 68.5 | 72 | 30.02 | 63.5 | 64 | 67 | 47 | 20 | 57 | .01 |
| 16 | 30.29 | 54.5 | 74 | 30.32 | 63 | 69 | 30.34 | 62 | 72 | 64 | 49.5 | 14.5 | 56.7 | .00 |
| 17 | 30.43 | 57 | 78 | 30.41 | 60.5 | 66 | 30.38 | 64.5 | 75 | 70.5 | 52.5 | 18 | 61.5 | .00 |
| 18 | 30.35 | 64 | 78 | 30.33 | 69 | 74 | 30.28 | 69 | 70 | 71.5 | 55.5 | 16 | 63.5 | .00 |
| 19 | 30.17 | 63 | 88 | 30.05 | 74 | 68 | 29.95 | 71 | 80 | 74 | 64.5 | 9.5 | 69.2 | .01 |
| 20 | 29.78 | 70 | 90 | 29.73 | 77.5 | 80 | 29.72 | 77 | 80 | 81 | 67 | 14 | 74 | .01 |
| 21 | 29.74 | 71.5 | 92 | 29.72 | 79 | 91 | 29.70 | 76.5 | 88 | 81.5 | 62 | 19.5 | 71.7 | .06 |
| 22 | 29.95 | 68 | 76 | 29.98 | 78.5 | 62 | 29.99 | 77.5 | 75 | 80.5 | 62 | 18.5 | 71.2 | .00 |
| 23 | 30.13 | 71.5 | 80 | 30.16 | 81 | 57 | 30.15 | 80 | 64 | 84 | 67 | 17 | 75.5 | .00 |
| 24 | 30.18 | 75 | 81 | 30.14 | 81 | 66 | 30.05 | 76.5 | 75 | 82 | 72 | 10 | 77 | .00 |
| 25 | 30.00 | 75 | 85 | 30.05 | 70 | 88 | 30.11 | 65 | 89 | 75 | 49.5 | 25.5 | 62.2 | .05 |
| 26 | 30.32 | 55 | 74 | 30.33 | 59 | 59 | 30.30 | 58 | 70 | 61.5 | 47 | 14.5 | 54.2 | .00 |
| 27 | 30.30 | 56 | 75 | 30.30 | 60.5 | 68 | 30.24 | 61 | 83 | 66 | 56.5 | 9.5 | 61.2 | .00 |
| 28 | 30.17 | 66 | 81 | 30.09 | 77 | 73 | 30.05 | 78 | 73 | 82 | 66 | 16 | 74 | .00 |
| 29 | 30.06 | 76 | 81 | 30.05 | 74.5 | 77 | 30.12 | 66.5 | 81 | 83 | 59 | 24 | 71 | 1.82 |
| 30 | 30.23 | 59 | 91 | 30.25 | 62 | 77 | 30.22 | 60 | 76 | 63 | 52 | 11 | 57.5 | .09 |
| 31 | 30.27 | 58.5 | 90 | 30.28 | 66 | 64 | 30.26 | 63 | 83 | 66 | 52 | 14 | 59 | .00 |

| | | | |
|---|---|---|---|
| Monthly range | 39°5 | | |
| Monthly mean | | 67°47 | |
| Monthly rainfall | | | 3.19 |

## METEOROLOGICAL RECORD FOR NOVEMBER, 1880.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.89 | 36°5 | 71 | 29.95 | 50° | 64 | 29.93 | 46° | 69 | 52°5 | 37° | 15°5 | 44°7 | .00 |
| 2 | 30.02 | 40 | 86 | 30.12 | 50 | 58 | 30.18 | 44 | 68 | 51 | 31.5 | 19.5 | 41.2 | .00 |
| 3 | 30.34 | 34 | 80 | 30.43 | 46 | 76 | 30.46 | 44 | 84 | 47.5 | 34.5 | 13 | 41 | .00 |
| 4 | 30.52 | 39.5 | 86 | 30.53 | 51 | 65 | 30.54 | 48 | 81 | 51.5 | 34.5 | 17 | 43 | .00 |
| 5 | 30.43 | 51 | 86 | 30.35 | 52.5 | 93 | 30.28 | 52 | 96 | 56 | 34.5 | 21.5 | 45.2 | .18 |
| 6 | 30.13 | 55 | 100 | 30.04 | 57.5 | 97 | 29.95 | 57 | 93 | 64.5 | 54 | 10.5 | 59.2 | .27 |
| 7 | 29.53 | 58.5 | 76 | 29.63 | 52 | 44 | 29.74 | 46 | 43 | 59 | 36 | 23 | 47.5 | .00 |
| 8 | 29.93 | 38 | 72 | 30.00 | 48 | 56 | 30.03 | 45 | 57 | 55 | 39 | 16 | 47 | .00 |
| 9 | 30.23 | 42 | 66 | 30.22 | 52 | 73 | 30.22 | 51 | 65 | 57 | 37 | 20 | 47 | .00 |
| 10 | 30.34 | 38.5 | 86 | 30.36 | 48 | 70 | 30.35 | 46 | 76 | 50 | 39 | 11 | 44.5 | .00 |
| 11 | 30.24 | 48 | 85 | 30.06 | 49.5 | 96 | 29.84 | 53 | 97 | 56 | 42.5 | 13.5 | 49.5 | .35 |
| 12 | 29.95 | 44.5 | 76 | 29.96 | 52 | 47 | 30.03 | 44 | 59 | 53 | 35.5 | 17.5 | 44.2 | .00 |
| 13 | 30.17 | 37.5 | 68 | 30.21 | 44 | 55 | 30.21 | 39.5 | 60 | 44.5 | 30 | 14.5 | 37.2 | .00 |
| 14 | 30.25 | 32 | 60 | 30.23 | 38.5 | 51 | 30.19 | 37 | 59 | 40.5 | 32.5 | 8 | 36.5 | .00 |
| 15 | 30.03 | 33.5 | 75 | 29.95 | 38 | 81 | 29.94 | 35 | 85 | 41 | 28 | 13 | 34.5 | .03 |
| 16 | 30.02 | 28.5 | 83 | 30.11 | 40 | 52 | 30.20 | 39.5 | 60 | 44.5 | 29.5 | 15 | 37 | .00 |
| 17 | 30.43 | 33.5 | 70 | 30.47 | 43 | 67 | 30.46 | 42 | 74 | 45 | 34 | 11 | 39.5 | .00 |
| 18 | 30.26 | 39.5 | 82 | 30.08 | 46 | 85 | 30.02 | 40 | 73 | 49 | 24 | 25 | 36.5 | .00 |
| 19 | 30.24 | 26 | 75 | 30.30 | 33 | 79 | 30.32 | 32 | 84 | 34.5 | 25 | 9.5 | 29.7 | .00 |
| 20 | 30.27 | 31 | 79 | 30.10 | 45 | 88 | 29.75 | 44 | 100 | 46.5 | 25.5 | 21 | 36 | 1.73 |
| 21 | 29.89 | 24.5 | 68 | 30.03 | 26.5 | 40 | 30.10 | 25 | 49 | 29 | 14.5 | 14.5 | 21.7 | .00 |
| 22 | 30.25 | 15 | 64 | 30.34 | 22.5 | 20 | 30.40 | 19 | 39 | 24 | 14 | 10 | 19 | .00 |
| 23 | 30.47 | 14 | 63 | 30.46 | 23 | 27 | 30.46 | 19.5 | 33 | 25 | 13 | 12 | 19 | .00 |
| 24 | 30.52 | 14 | 63 | 30.55 | 27 | 41 | 30.55 | 29 | 44 | 29.5 | 14.5 | 15 | 22 | .02 |
| 25 | 30.44 | 28 | 71 | 30.36 | 32.5 | 60 | 30.33 | 29 | 44 | 37 | 12.5 | 24.5 | 24.7 | .00 |
| 26 | 30.38 | 15 | 56 | 30.45 | 25 | 69 | 30.46 | 24 | 74 | 27 | 13.5 | 13.5 | 20.2 | .00 |
| 27 | 30.46 | 15 | 65 | 30.46 | 34 | 62 | 30.44 | 31.5 | 68 | 35 | 15.5 | 19.5 | 25.2 | .00 |
| 28 | 30.42 | 19.5 | 77 | 30.37 | 33.5 | 75 | 30.28 | 31.5 | 68 | 35 | 21 | 14 | 28 | .04 |
| 29 | 29.97 | 32 | 95 | 29.94 | 41 | 74 | 29.95 | 38 | 64 | 43 | 23 | 20 | 33 | .00 |
| 30 | 30.14 | 22 | 44 | 30.26 | 32 | 60 | 30.29 | 29 | 66 | 34 | 22.5 | 11.5 | 28.2 | .20 |

Monthly range ................... ...................52°
Monthly mean .................................... 30°07
Monthly rainfall .................................... 2.82

## METEOROLOGICAL RECORD FOR OCTOBER, 1880.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.37 | 45° | 76 | 30.37 | 56°5 | 51 | 30.36 | 52°5 | 66 | 57°5 | 42° | 15°5 | 49°7 | .00 |
| 2 | 30.37 | 48 | 81 | 30.35 | 57 | 61 | 30.35 | 54 | 80 | 58.5 | 45.5 | 13 | 52 | .00 |
| 3 | 30.33 | 54 | 86 | 30.29 | 58.5 | 82 | 30.24 | 58.5 | 72 | 62 | 55 | 7 | 58.5 | .00 |
| 4 | 30.15 | 59 | 94 | 30.05 | 69.5 | 77 | 29.97 | 64 | 86 | 70 | 53 | 17 | 61.5 | .07 |
| 5 | 30.05 | 53 | 86 | 30.01 | 54 | 86 | 29.98 | 51 | 86 | 55.5 | 44 | 11.5 | 49.7 | .03 |
| 6 | 29.89 | 50 | 93 | 29.85 | 63 | 47 | 29.48 | 56.5 | 49 | 69.5 | 42 | 27.5 | 55.7 | .00 |
| 7 | 30.02 | 47 | 70 | 30.07 | 56 | 57 | 30.11 | 53 | 61 | 57 | 37 | 20 | 47 | .00 |
| 8 | 30.26 | 48 | 75 | 30.30 | 51 | 73 | 30.31 | 51 | 79 | 54 | 41 | 13 | 47.5 | .00 |
| 9 | 30.36 | 46.5 | 81 | 30.34 | 60 | 65 | 30.31 | 57 | 69 | 62 | 44 | 18 | 53 | .00 |
| 10 | 30.31 | 48.5 | 93 | 30.32 | 57 | 78 | 30.31 | 53 | 93 | 59 | 49 | 10 | 54 | .00 |
| 11 | 30.31 | 53 | 100 | 30.26 | 61 | 83 | 30.22 | 59 | 87 | 64.5 | 53.5 | 11 | 59 | .00 |
| 12 | 30.04 | 59 | 94 | 29.90 | 73 | 67 | 29.94 | 57.5 | 63 | 74 | 41 | 33 | 57.5 | .06 |
| 13 | 30.18 | 42 | 68 | 29.20 | 52 | 47 | 29.20 | 49 | 50 | 55 | 34 | 21 | 44.5 | .00 |
| 14 | 30.25 | 42 | 66 | 30.22 | 56 | 60 | 30.11 | 52.5 | 76 | 60 | 42 | 18 | 51 | .00 |
| 15 | 30.02 | 46 | 80 | 29.98 | 60 | 65 | 29.95 | 55 | 81 | 62.5 | 46 | 16.5 | 54.2 | .00 |
| 16 | 29.98 | 51 | 86 | 29.95 | 63.5 | 72 | 29.92 | 61 | 83 | 65.5 | 51 | 14.5 | 58.2 | .00 |
| 17 | 29.85 | 61.5 | 94 | 29.82 | 71.5 | 76 | 29.77 | 66 | 87 | 72 | 42 | 30 | 57 | .09 |
| 18 | 30.07 | 43 | 87 | 30.08 | 52 | 60 | 30.12 | 45 | 60 | 52 | 38 | 14 | 45 | .00 |
| 19 | 30.33 | 39 | 73 | 30.30 | 49 | 57 | 30.28 | 45 | 60 | 50.5 | 40 | 10.5 | 45.2 | .00 |
| 20 | 30.36 | 41 | 57 | 30.36 | 51 | 59 | 30.36 | 47 | 66 | 51 | 40 | 11 | 45.5 | .00 |
| 21 | 30.43 | 44.5 | 84 | 30.40 | 53 | 66 | 30.36 | 51.5 | 83 | 55 | 45.5 | 9.5 | 50.2 | .00 |
| 22 | 30.28 | 52 | 93 | 30.20 | 54 | 89 | 30.06 | 50.5 | 93 | 55.5 | 46 | 9.5 | 50.7 | 1.22 |
| 23 | 29.49 | 51 | 82 | 29.50 | 60 | 71 | 29.50 | 53.5 | 86 | 61 | 40 | 21 | 50.5 | .11 |
| 24 | 29.67 | 39.5 | 82 | 29.73 | 44 | 59 | 29.78 | 37.5 | 68 | 45 | 29.5 | 15.5 | 37.2 | .00 |
| 25 | 29.95 | 31 | 68 | 30.01 | 42 | 58 | 30.04 | 40 | 65 | 45.5 | 31 | 14.5 | 38.2 | .00 |
| 26 | 30.06 | 34 | 80 | 30.03 | 47 | 70 | 29.94 | 49.5 | 82 | 52.5 | 35 | 17.5 | 43.7 | .02 |
| 27 | 29.92 | 50 | 86 | 30.00 | 49 | 71 | 30.04 | 40.5 | 77 | 51 | 33 | 18 | 42 | .00 |
| 28 | 30.30 | 35 | 71 | 30.32 | 41 | 66 | 30.31 | 38 | 81 | 47 | 27.5 | 19.5 | 37.2 | .00 |
| 29 | 30.32 | 30 | 78 | 30.34 | 45 | 72 | 30.32 | 43 | 83 | 48 | 42.5 | 5.5 | 45.2 | .00 |
| 30 | 30.21 | 47 | 85 | 30.12 | 51 | 86 | 30.00 | 50.5 | 89 | 57 | 48 | 9 | 52.5 | .71 |
| 31 | 29.56 | 55.5 | 97 | 29.53 | 58 | 70 | 29.50 | 47 | 70 | 61 | 33 | 28 | 47 | .02 |

Monthly range ................................ 46°5

Monthly mean ................................ 49°70

Monthly rainfall ...... ........................ 2.33

## METEOROLOGICAL RECORD FOR NOVEMBER, 1880.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.89 | 36°5 | 71 | 29.95 | 50° | 64 | 29.93 | 46° | 69 | 52°5 | 37° | 15°5 | 44°7 | .00 |
| 2 | 30.02 | 40 | 86 | 30.12 | 50 | 58 | 30.18 | 44 | 68 | 51 | 31.5 | 19.5 | 41.2 | .00 |
| 3 | 30.34 | 34 | 80 | 30.43 | 46 | 76 | 30.46 | 44 | 84 | 47.5 | 34.5 | 13 | 41 | .00 |
| 4 | 30.52 | 39.5 | 86 | 30.53 | 51 | 65 | 30.54 | 48 | 81 | 51.5 | 34.5 | 17 | 43 | .00 |
| 5 | 30.43 | 51 | 86 | 30.35 | 52.5 | 93 | 30.28 | 52 | 96 | 56 | 34.5 | 21.5 | 45.2 | .18 |
| 6 | 30.13 | 55 | 100 | 30.04 | 57.5 | 97 | 29.95 | 57 | 93 | 64.5 | 54 | 10.5 | 59.2 | .27 |
| 7 | 29.53 | 58.5 | 76 | 29.63 | 52 | 44 | 29.74 | 46 | 43 | 59 | 36 | 23 | 47.5 | .00 |
| 8 | 29.93 | 38 | 72 | 30.00 | 48 | 56 | 30.03 | 45 | 57 | 55 | 39 | 16 | 47 | .00 |
| 9 | 30.23 | 42 | 66 | 30.22 | 52 | 73 | 30.22 | 51 | 65 | 57 | 37 | 20 | 47 | .00 |
| 10 | 30.34 | 38.5 | 86 | 30.36 | 48 | 70 | 30.35 | 46 | 76 | 50 | 39 | 11 | 44.5 | .00 |
| 11 | 30.24 | 48 | 85 | 30.06 | 49.5 | 96 | 29.84 | 53 | 97 | 56 | 42.5 | 13.5 | 49.5 | .35 |
| 12 | 29.95 | 44.5 | 76 | 29.96 | 52 | 47 | 30.03 | 44 | 59 | 53 | 35.5 | 17.5 | 44.2 | .00 |
| 13 | 30.17 | 37.5 | 68 | 30.21 | 44 | 55 | 30.21 | 39.5 | 60 | 44.5 | 30 | 14.5 | 37.2 | .00 |
| 14 | 30.25 | 32 | 60 | 30.23 | 38.5 | 51 | 30.19 | 37 | 59 | 40.5 | 32.5 | 8 | 36.5 | .00 |
| 15 | 30.03 | 33.5 | 75 | 29.95 | 38 | 81 | 29.94 | 35 | 85 | 41 | 28 | 13 | 34.5 | .03 |
| 16 | 30.02 | 28.5 | 83 | 30.11 | 40 | 52 | 30.20 | 39.5 | 60 | 44.5 | 29.5 | 15 | 37 | .00 |
| 17 | 30.43 | 33.5 | 70 | 30.47 | 43 | 67 | 30.46 | 42 | 74 | 45 | 34 | 11 | 39.5 | .00 |
| 18 | 30.26 | 39.5 | 82 | 30.08 | 46 | 85 | 30.02 | 40 | 73 | 49 | 24 | 25 | 36.5 | .00 |
| 19 | 30.24 | 26 | 75 | 30.30 | 33 | 79 | 30.32 | 32 | 84 | 34.5 | 25 | 9.5 | 29.7 | .00 |
| 20 | 30.27 | 31 | 79 | 30.10 | 45 | 88 | 29.75 | 44 | 100 | 46.5 | 25.5 | 21 | 36 | 1.73 |
| 21 | 29.89 | 24.5 | 68 | 30.03 | 26.5 | 40 | 30.10 | 25 | 49 | 29 | 14.5 | 14.5 | 21.7 | .00 |
| 22 | 30.25 | 15 | 64 | 30.31 | 22.5 | 20 | 30.40 | 19 | 39 | 24 | 14 | 10 | 19 | .00 |
| 23 | 30.47 | 14 | 63 | 30.46 | 23 | 27 | 30.46 | 19.5 | 33 | 25 | 13 | 12 | 19 | .00 |
| 24 | 30.52 | 14 | 63 | 30.55 | 27 | 41 | 30.55 | 29 | 44 | 29.5 | 14.5 | 15 | 22 | .02 |
| 25 | 30.44 | 28 | 71 | 30.36 | 32.5 | 60 | 30.33 | 29 | 44 | 37 | 12.5 | 24.5 | 24.7 | .00 |
| 26 | 30.38 | 15 | 56 | 30.45 | 25 | 69 | 30.46 | 24 | 74 | 27 | 13.5 | 13.5 | 20.2 | .00 |
| 27 | 30.46 | 15 | 65 | 30.46 | 34 | 62 | 30.44 | 31.5 | 68 | 35 | 15.5 | 19.5 | 25.2 | .00 |
| 28 | 30.42 | 19.5 | 77 | 30.37 | 33.5 | 75 | 30.28 | 31.5 | 68 | 35 | 21 | 14 | 28 | .04 |
| 29 | 29.97 | 32 | 95 | 29.94 | 41 | 74 | 29.95 | 38 | 64 | 43 | 23 | 20 | 33 | .00 |
| 30 | 30.14 | 22 | 44 | 30.26 | 32 | 60 | 30.29 | 29 | 66 | 34 | 22.5 | 11.5 | 28.2 | .20 |

| | |
|---|---|
| **Monthly range** ................. ..................... | 52° |
| **Monthly mean** ..................................... | 30°07 |
| **Monthly rainfall** ..................................... | 2.82 |

## METEOROLOGICAL RECORD FOR DECEMBER, 1880.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.19 | 28°5 | 100 | 29.85 | 34° | 95 | 29.76 | 22°5 | 79 | 35° | 20°5 | 14°5 | 27°7 | .68 |
| 2 | 29.87 | 24 | 86 | 29.87 | 28.5 | 60 | 29.89 | 20 | 57 | 30 | 19.5 | 10.5 | 24.7 | .00 |
| 3 | 29.98 | 21 | 71 | 30.00 | 32 | 73 | 30.03 | 26.5 | 70 | 32 | 22 | 10 | 27 | .00 |
| 4 | 30.08 | 23 | 60 | 30.09 | 32 | 64 | 30.10 | 30.5 | 74 | 34 | 24.5 | 9.5 | 29.2 | .00 |
| 5 | 30.14 | 29.5 | 73 | 30.04 | 39 | 95 | 29.85 | 42 | 92 | 43 | 32 | 11 | 37.5 | .50 |
| 6 | 29.78 | 39 | 91 | 29.80 | 41 | 87 | 29.78 | 37 | 76 | 43 | 29 | 14 | 36 | .00 |
| 7 | 29.72 | 29 | 83 | 29.75 | 29.5 | 73 | 29.78 | 26 | 63 | 32 | 16.5 | 15.5 | 24.2 | .00 |
| 8 | 30.01 | 16.5 | 49 | 30.00 | 25 | 74 | 29.98 | 23.5 | 60 | 27 | 13.5 | 13.5 | 20.2 | .00 |
| 9 | 30.25 | 13.5 | 54 | 30.28 | 25 | 62 | 30.31 | 22 | 51 | 27 | 14.5 | 12.5 | 20.7 | .00 |
| 10 | 30.36 | 15.5 | 57 | 30.34 | 21 | 71 | 30.32 | 19 | 69 | 22.5 | 11 | 11.5 | 16.7 | .10 |
| 11 | 30.33 | 11.5 | 60 | 30.32 | 22.5 | 66 | 30.26 | 25 | 74 | 27.5 | 12 | 15.5 | 19.7 | .00 |
| 12 | 30.09 | 20 | 63 | 30.07 | 31.5 | 74 | 30.03 | 32.5 | 70 | 38 | 20.5 | 17.5 | 29.2 | .00 |
| 13 | 29.85 | 36 | 81 | 29.77 | 42.5 | 83 | 29.75 | 41 | 66 | 44.5 | 32 | 12.5 | 38.2 | .01 |
| 14 | 29.83 | 32 | 79 | 29.89 | 40.5 | 74 | 29.88 | 38 | 72 | 42 | 36 | 6 | 39 | .59 |
| 15 | 29.59 | 37 | 18 | 29.61 | 42.5 | 75 | 29.62 | 39 | 73 | 43 | 32.5 | 10.5 | 37.7 | .00 |
| 16 | 29.10 | 32.5 | 75 | 29.69 | 35.5 | 58 | 29.69 | 31 | 63 | 37 | 18 | 19 | 27.5 | .00 |
| 17 | 29.71 | 18 | 60 | 29.73 | 24 | 48 | 29.76 | 22 | 72 | 26 | 16.5 | 9.5 | 21.2 | .00 |
| 18 | 29.81 | 18 | 52 | 29.77 | 23 | 53 | 29.75 | 21 | 64 | 25.5 | 16 | 9.5 | 20.7 | .00 |
| 19 | 29.81 | 18 | 52 | 29.82 | 32.5 | 75 | 29.22 | 28 | 77 | 34.5 | 18.5 | 16 | 26.5 | .00 |
| 20 | 30.08 | 23.5 | 80 | 30.09 | 35 | 75 | 30.09 | 32 | 79 | 37 | 23.5 | 13.5 | 30.2 | .00 |
| 21 | 30.01 | 32.5 | 79 | 29.92 | 26.5 | 82 | 29.88 | 31 | 78 | 32.5 | 25.5 | 7 | 29 | .00 |
| 22 | 29.97 | 25.5 | 75 | 30.01 | 33 | 66 | 30.04 | 31 | 63 | 33 | 22 | 11 | 27.5 | .00 |
| 23 | 30.18 | 22.5 | 66 | 30.21 | 36 | 63 | 30.24 | 33 | 66 | 38 | 23.5 | 14.5 | 30.7 | .01 |
| 24 | 29.36 | 27 | 76 | 30.37 | 32.5 | 84 | 30.38 | 33 | 89 | 33.5 | 28 | 5.5 | 30.7 | .01 |
| 25 | 30.40 | 27.5 | 82 | 30.44 | 31.5 | 74 | 30.43 | 33 | 66 | 36 | 25.5 | 10.5 | 30.7 | .02 |
| 26 | 30.36 | 34.5 | 75 | 30.22 | 33.5 | 70 | 30.09 | 33 | 79 | 36.5 | 28 | 8.5 | 32.2 | .11 |
| 27 | 29.77 | 28 | 88 | 29.73 | 32 | 79 | 29.72 | 32.5 | 75 | 34.5 | 26 | 8.5 | 30.2 | .01 |
| 28 | 29.67 | 26 | 51 | 29.76 | 22.5 | 72 | 29.88 | 18 | 68 | 26 | 14.5 | 11.5 | 20.2 | .02 |
| 29 | 29.96 | 14.5 | 72 | 29.91 | 17.5 | 67 | 29.80 | 14 | 81 | 20.5 | 1.5 | 19 | 11 | .28 |
| 30 | 29.70 | 1.5 | 57 | 29.79 | 7 | 39 | 29.87 | 5 | 26 | 8.5 | 0 | 8.5 | 4.2 | .00 |
| 31 | 30.13 | 3 | 46 | 30.17 | 14.5 | 54 | 30.18 | 13 | 44 | 17.5 | 0.5 | 18 | 8.5 | .00 |

| | |
|---|---|
| Monthly range .................................... | 45° |
| Monthly mean .................................... | 26°12 |
| Monthly rainfall. .................................... | 2.34 |
| Total rainfall for the year........................ .... | 33.05 |

840132

478

# TENTH ANNUAL REPORT

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ASTOR, LENOX AND
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# PUBLIC WATER BOARD

OF THE

# CITY OF LYNN,

For the Year Ending December 31, 1881.

LYNN
MASS.
SETTLED 1629. INSTITUTED A CITY MAY 14 1850.

LYNN, MASS.
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1882.

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# TENTH ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD

OF THE

# CITY OF LYNN,

FOR THE YEAR ENDING DECEMBER 31, 1881.

*Compliments of*

*Public Water Board.*

*Please exchange*

LYNN, MASS.:
JOHN MACFARLANE & CO., PRINTERS,
No. 55 MUNROE STREET.
1882.

THE NEW
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102179

# PUBLIC WATER BOARD.

## OFFICERS FOR 1882.

**EDWIN WALDEN**, *President*,
For four years.

**THOMAS B. NEWHALL**,
For five years.

**JOSEPH M. ROWELL**,
For three years.

**JAMES N. BUFFUM**,
For two years.

**DAVID H. SWEETSER**,
For one year.

*Superintendent and Clerk*,
**DANIEL WALDEN**.

*Water Registrar*,
**SIMON J. RONEY**.

*Pumping Engineer*,
**WILLIAM H. MESSENGER**.

*Inspector*,
**CHARLES H. CLIFFORD**.

*Foreman of Pipe Works*,
**EDWIN MAXWELL**.

## ANNUAL REPORT

# PUBLIC WATER BOARD.

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OFFICE OF THE PUBLIC WATER BOARD,
*January 16, 1882.*

The Public Water Board hereby presents to the City Council its Tenth Annual Report, together with the reports of the Superintendent and Water Registrar.

The reports of the Superintendent and Registrar present so fully the condition of the works, and so much important information regarding the department, that a lengthy report from the Board would seem unnecessary.

The report of the Superintendent shows the condition of the ponds, the reservoir and pumping works; the rainfall, and the amount collected; the quantity of water used; a statement showing the consumption of water, compared with other cities; and carefully prepared tables, which can be profitably studied by those who desire information in regard to our water supply.

The Registrar's report shows the receipts and expenditures for the past year, the cost of maintenance, and the amount expended for construction; also, statements showing the number of consumers, the number and kinds of fixtures in use, and much other information that will be found interesting and useful.

These reports furnish an array of facts of much value to those seeking knowledge of the working of the department.

## RECEIPTS AND EXPENDITURES.

It will be seen that while the revenue for 1881 was $80,967.76, an increase over that of 1880 of $1,332.64, the excess of the revenue over interest and maintenance was but $14,178.96, which amount is $2,948.23 less than the surplus in 1880. This decrease in the net earnings is accounted for by the increase in the item of interest, $960, and the cost of maintenance, which was greater than the previous year by $3,320.87. The increase in the cost of maintenance was owing to the higher price paid for coal, the cost of running the tubular wells last year, which was charged to maintenance, and extra repairs to services, hydrants and meters.

Notwithstanding the increase in the items mentioned, the department would have shown a handsome gain in surplus over 1880 if the City Council had made the same allowance for use of water for fire purposes as in former years.

The City Council of last year reduced the appropriation for this purpose from $10,000 to $5,000, thus throwing upon the Water Department a burden that, in the opinion of the Board, should be borne by another department, or assumed by the city. The cost of our water works has been largely increased, in order to furnish an ample supply of water available at all times for extinguishing fires. All classes share in the benefit and security thus provided. Why should they not pay a fair proportion of the expense incurred in furnishing this protection? When the great saving in the cost of insurance to our citizens is considered, as well as the lessened expense in the Fire Department, it would seem that $10,000 per annum is not too large a sum to credit the Water Department for the use of water for fire purposes.

## CONSTRUCTION.

There has been charged to construction the past year, $24,430.76. Of this sum, $23,487.93 was spent in laying new mains, hydrants, gates and services; 20,537 feet of distributing mains have been laid in forty-two streets, by order of the City Council; and 3,305 feet of smaller pipes in courts; making a total of over four and one-half miles of main pipe laid during the year. This has added largely to the cost of the works, and requires a larger sum for interest on the increased debt to be provided for. To what extent the petitions for new mains should be granted, is a question that needs careful consideration. The rule of the Water Board has been to recommend the laying of pipes if the probable income would amount to 5 per cent. on the cost, relying upon the future growth of the locality thus accommodated to furnish a fair remuneration for the outlay. The City Council, in former years, has generally been governed by the recommendations of the Board. Last year, however, the Committee on Water Supply favored the laying of pipes wherever asked for, notwithstanding the Water Board, after careful investigation, in many cases refused to recommend it. The result, as has been shown, was to largely increase the construction account, without ensuring an adequate income to offset interest charges. Such a policy tends to delay the time when a reduction of rates to water-takers can be made. The Board believes in, and has always adopted, a liberal policy towards those who desire the city water, but it is hardly just to our citizens that the water debt should be largely increased in laying pipes through sparsely settled streets, many of them not graded or accepted, or where expensive rock excavations are necessary, when the receipts from water-takers on such lines of pipe will furnish no adequate compensation for the expense incurred.

## COST OF THE WORKS.

| | | |
|---|---|---|
| Total gross cost of the works, Jan. 1, 1881 | | $1,084,234 85 |
| Add Construction account for 1881 | | 24,430 76 |
| Total gross cost of works, Jan. 1, 1882. | | $1,108,665 61 |
| Less receipts from water-takers for extra pipe laid, labor, etc. | $37,668 59 | |
| Less premium on bonds sold | 9,750 00 | |
| Less income in excess of interest payments,[*] and cost of maintenance, 1879, 1880, 1881 | 44,319 04 | |
| | | $91,737 63 |
| Total net cost of works, Jan. 1, 1882. | | $1,016,927 98 |

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[*] This amount includes no appropriations to Water Loan Sinking Fund made by the City Council, or earnings of the fund since it was established.

## PONDS.

From the figures given in the Superintendent's report, it will be seen that our storage basins would have proved sufficient to have stored all the surplus water, and no waste would have taken place, if we had not used the water of the tubular wells.

The year 1881 was one of unusually heavy spring rains. These rains occurred when the conditions were most favorable for collecting a large percentage of the rainfall. The reports from most of the sources of supply of other cities in New England were that millions of gallons of water were running to waste. If, in such an exceptional year, our ponds have proved large enough to hold all the water which came to them, it is shown conclusively that, with our present consumption, we have ample storage capacity for all the water that the water-shed will furnish; and that nothing would be gained by increasing the size of the ponds, unless we can add to the water-shed that supplies them.

## WATER SUPPLY.

Owing to the favorable conditions before mentioned, our ponds have furnished during the year an abundance of water, and we have been relieved from the fear of a short supply, and from the necessity of resorting to the tubular wells. The water from both ponds has been of superior quality, and we have heard no complaint of the disagreeable taste and odor that in former years has caused so much trouble, and has affected so largely the supply of other cities.

We would call particular attention to the recent analysis made by Dr. Wood, of Harvard Medical College, which shows the water of both ponds to be of a quality not excelled by any public water supply in the state.

Although our citizens have thus far escaped the calamity of a short supply of water, we should be alive to the fact that we cannot always depend upon the conditions that have been so favorable. Years of rainfall below the average will surely come, and with the rapid increase in the number of consumers, the City Council cannot long delay consideration of the question of adding to our water supply. When we realize the importance of an abundant supply of water to a community accustomed to depend upon it for domestic and manufacturing uses, and the serious consequences that would arise if we should fall short, it would seem that no more important subject can claim its attention.

The report of the Water Registrar shows that the ratio of increase in the number of services has risen in the past six years from 5.25 per cent. in 1875 to 10.25 per cent. in 1881. True, our consumption of water has not increased in proportion to the number of takers. If it had, we should have been out of water long ago. Owing to the fear of a short supply of water, and the watchful supervision and constant warning of the Water Board, the average consumption of water in our city has been reduced to a very low point. The Superintendent, in his report, shows that the average daily consumption is 32 9-100 gallons for each inhabitant, while the average consumption in forty-nine cities, of from 10,000 to 50,000 population, is 72 53-100 gallons; that is, our city uses considerably less than one-half as much water per capita as is used in the forty-nine cities referred to, and which comprises all the cities in the country within the range of population mentioned that have public water supplies. The estimates of both McAlpine and Kirkwood, one made in 1870 and the other in 1876, based upon the probable growth of the city in population, were that the daily consumption of water in the year 1880 would be over 1,800,000 gallons. These estimates were based upon the experience of other cities. The census returns of 1880 show that their estimates of the growth of the city in population were not far from the actual figures; but the quantity of water consumed was, fortunately, much below their estimates. These eminent engineers could not foresee, neither could the Water Board, that our city would be so exceptional in the quantity of water used per capita.

Much of the opposition towards adding to our supply of water comes from those who believe our present sources sufficient. They think the Water Board has caused unnecessary alarm; that there has been no occasion for the constant warnings and demand for economy in the use of water. Do they think that this economy would have been practiced but for the repeated admonitions of the Water Board? Those who are conversant with the facts know that twice since Lynn has had a public supply we should have been out of water if the drought had continued but a few days longer, but the welcome rains came to our relief, and the danger which was imminent was averted.

Who could foresee that the average consumption per capita in the city of Lynn for the year 1881 would be but 44 per cent. of the average consumption of the cities of the country? Would calculations for a water supply, based upon a presumption that our city would use less than her sister cities, have been wise? Or, would it be prudent to estimate our future requirements upon the supposition that this economy will always continue?

We have now arrived at a point when we must expect a large increase in the quantity of water used. The rapid increase in the number of takers must soon be felt in a much larger consumption of water. We can not rely upon economy in its use to be carried further, and prudence would seem to dictate that measures be taken at an early date to add to our sources of supply.

The towns of Nahant, Swampscott and Saugus are feeling the necessity for a water supply. Unable to construct expensive works, they naturally look to us to furnish them. They would be profitable customers, as the rates received from them would go far towards paying the interest on the outlay for an addition to our present sources of supply.

*For the Public Water Board,*

EDWIN WALDEN.
THOMAS B. NEWHALL.
DAVID H. SWEETSER.

# REPORT OF THE WATER REGISTRAR.

*Hon. Edwin Walden, President of the Public Water Board:*

DEAR SIR:—I have the honor to respectfully present, herewith, the report of the Water Registrar, for the year ending Dec. 31, 1881.

## SERVICES.

The whole number of services Jan. 1, 1881, was 4488; number of new services put in during the year, 461; number discontinued — buildings moved — 2; total number services, Jan. 1, 1882, 4948. There was shut off during the year, for non-payment of rates, 26; let on again, by payment of rates and fines, 11; let on for other parties, the premises having changed owners, 3: still remaining off, 12; number let on that were shut off previous to 1881, 3.

Jan. 1, 1881, there were 35 services remaining off — premises vacant: there have been shut off during the year, for the same cause, or by request, 106; let on again — premises re-occupied, 92; still remaining off, 49. There have been three services put in at East Saugus, during the year, making in all, to Jan. 1, 1882, 53.

The ratio of increase in the number of services for the last seven years has been as follows:

| | | | |
|---|---|---|---|
| In 1875 . . . . | 5.25 per cent. | In 1878 . . . . | 6.14 per cent. |
| In 1876 . . . . | 6.54 " " | In 1879 . . . . | 6.04 " " |
| In 1877 . . . . | 7.60 " " | In 1880 . . . . | 8.75 " " |
| In 1881 . . . . | 10.25 per cent. | | |

The premises supplied with city water have been partly examined by the inspector, and all fixtures found to be leaking or out

**of order, the owners or occupants were notified to have them repaired, and put in good order, immediately, or the water would be shut off from their premises, and not let on again until such repairs were made and the usual fine in such cases paid. One inspector is not able to inspect all the fixtures of the water-takers, every year, with the other duties he is called on to perform, such as distributing bills, summons, etc., etc., and I would respectfully suggest that, if the Board desires to have all the fixtures of water-takers thoroughly examined, it will be necessary to have another inspector to assist in the performance of that duty.**

### RECEIPTS FOR THE YEAR 1881.

| | | |
|---|---|---|
| For use of water for all purposes . . . . | $80,219 50 | |
| For fines — shutting off and letting on again | 26 00 | |
| For rent . . . . . . . . . . . . . . . . | 25 00 | |
| For summonses . . . . . . . . . . . . | 118 80 | |
| | | $80,389 30 |
| For extra pipe . . . . . . . . . . . . | | 1,714 14 |
| Total receipts . . . . . . . . . . . . | | $82,103 44 |

All of which has been paid into the city treasury.

There is due on water rates $21 ; on meter rates, $3191.21 ; on account of extra pipe, $935.70.

### EXPENDITURES FOR 1881.

#### MAINTENANCE.

| | | |
|---|---|---|
| Salaries and office expenses . . . . . . . | $3,282 37 | |
| Repairs on services and meters . . . . . | 2,264 04 | |
| Repairs on mains, hydrants and gates . . . | 1,253 12 | |
| Repairs on engine house . . . . . . . . | 25 38 | |
| Pumping, wages, coal, oil, etc., etc . . . . | 1,593 87 | |
| Repairs on engine and boilers . . . . . . | 129 80 | |
| Stable and work-shop . . . . . . . . . | 762 89 | |
| Labor at Breed's Pond . . . . . . . . | 68 40 | |
| Labor at Birch Pond . . . . . . . . . . | 19 05 | |
| Labor at Reservoir . . . . . . . . . . . | 252 37 | |
| Pumping at tubular wells . . . . . . . . | 947 51 | |
| Total maintenance . . . . . . . . . . . | | $13,598 80 |

### CONSTRUCTION.

| | | |
|---|---|---|
| Services and court mains | 9,770 75 | |
| Mains, hydrants and gates | 13,717 18 | |
| Tubular wells | 5 27 | |
| Meters | 330 21 | |
| Engine house and lot | 10 00 | |
| Breed's Pond road | 568 01 | |
| Work-shop and shed | 29 34 | |
| Total construction | | $24,430 76 |

### COMPARATIVE STATEMENT OF REVENUE FOR 1881.

| | | |
|---|---|---|
| Amount collected in 1881 | $80,389 30 | |
| Due and uncollected | 3,212 21 | |
| | | $83,601 51 |
| Deduct amount due at beginning of year | | 2,633 75 |
| Revenue for 1881 | | 80,967 76 |
| Revenue for 1880 | | 79,635 12 |
| Increase of revenue for 1881 | | $1,332 64 |

### STATEMENT OF INTEREST, MAINTENANCE AND REVENUE FOR THE YEAR 1881.

| | | |
|---|---|---|
| Revenue for 1881 | | $80,967 76 |
| Interest for 1881 | $53,190 00 | |
| Maintenance for 1881 | 13,598 80 | |
| | | 66,788 80 |
| Excess of revenue over interest and maintenance | | $14,178 96 |

Following are tables showing the number of families, dwellings, stores, factories, etc., etc., the yearly revenue of the department, the class of premises to which meters are attached, the number and kind of fixtures, etc., etc.

All of which is respectfully submitted,

SIMON J. RONEY,
*Water Registrar.*

# STATEMENT

## SHOWING THE NUMBER OF FAMILIES, DWELLINGS, STORES, FACTORIES, ETC., SUPPLIED WITH CITY WATER FOR 1881.

| | |
|---|---|
| Dwellings | 4052 |
| Families | 6409 |
| Boarding-houses | 75 |
| Hotels | 7 |
| Stores and shops | 316 |
| Offices | 153 |
| Restaurants and saloons | 49 |
| Stables | 230 |
| Stationary steam engines | 78 |
| Factories | 151 |
| Railroads | 3 |
| Steam fire engine-houses | 4 |
| School-houses | 28 |
| Churches | 14 |
| Public halls | 14 |
| Printing offices | 9 |
| Greenhouses | 9 |
| Bakeries | 8 |
| Barber shops | 14 |
| Planing mills | 4 |
| Machine and blacksmith shops | 12 |
| Markets | 8 |
| Banks | 6 |
| Photographers | 6 |
| Public and drinking fountains | 8 |
| Motors | 8 |
| Laundries | 4 |
| Reservoirs | 4 |
| Foundry | 1 |
| Private fountains | 15 |
| Gas works | 1 |
| Steam heating works | 1 |
| Hand hose | 1029 |
| Old Ladies' Home | 1 |
| City Hall | 1 |
| Almshouse | 1 |
| Post office | 1 |
| Fire hydrants | 453 |

## STATEMENT

### SHOWING THE YEARLY REVENUE OF THE DEPARTMENT SINCE THE FIRST INTRODUCTION OF WATER INTO THE CITY IN 1871.

| | |
|---|---|
| From October 1, 1871, to January 1, 1872 . . . . . | $ 8,989 00 |
| From January 1, 1872, to January 1, 1873 . . . . . | 27,568 16 |
| From January 1, 1873, to January 1, 1874 . . . . . | 47,992 61 |
| From January 1, 1874, to January 1, 1875 . . . . . | 53,545 61 |
| From January 1, 1875, to January 1, 1876 . . . . . | 52,553 26 |
| From January 1, 1876, to January 1, 1877 . . . . . | 60,867 12 |
| From January 1, 1877, to January 1, 1878 . . . . . | 64,002 50 |
| From January 1, 1878, to January 1, 1879 . . . . . | 67,570 14 |
| From January 1, 1879, to January 1, 1880 . . . . . | 73,949 80 |
| From January 1, 1880, to January 1, 1881 . . . . . | 79,635 12 |
| From January 1, 1881, to January 1, 1882 . . . . . | *80,967 76 |
| Total . . . . . . . . . . . . . . . . . . . . | $617,641 08 |

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* The comparatively small increase of revenue over the previous year is accounted for from the fact that the city council cut down the appropriation for water for fire hydrants from $10,000, which it had been in previous years, to $5,000.

# STATEMENT

### SHOWING THE NUMBER AND KIND OF FIXTURES CONTAINED WITHIN THE PREMISES OF WATER TAKERS TO DEC. 31, 1881, AS COMPARED WITH THE PREVIOUS YEAR.

| Kind of Fixtures. | 1880. | 1881. | Increase. | Decrease |
|---|---|---|---|---|
| Faucets . . . . . . . . . . | 8870 | 9485 | 606 | |
| Bath tubs . . . . . . . . . . | 481 | 532 | 51 | |
| Water closets . . . . . . . | 1483 | 1552 | 69 | |
| Urinals . . . . . . . . . . | 38 | 56 | 18 | |
| Hand hose . . . . . . . . . | 1047 | 1029 | | 16 |

## STATEMENT

### EXHIBITING THE CLASS OF PREMISES TO WHICH METERS ARE ATTACHED.

| Class. | Size. | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | 1-2 | 5-8 | 3-4 | 1 | 1 1-4 | 1 1-2 | 2 | |
| Railroads | | | 6 | 1 | | | 2 | 9 |
| Engines | | 5 | 7 | 14 | 2 | 2 | | 30 |
| Factories | 3 | 23 | 27 | 22 | 1 | | | 76 |
| Halls and buildings | | | 3 | 4 | | | | 7 |
| Hotel | | 1 | | | | | | 1 |
| Livery stables | | 5 | | | | | | 5 |
| Saloons | | | 1 | 1 | | | | 2 |
| Laundry | | 1 | | | | | | 1 |
| Gas works | | | | | | 1 | | 1 |
| Steam fire engine-houses | | | | 1 | | | | 1 |
| Dwellings | | 1 | | | | | | 1 |
| Printing office | | 1 | | | | | | 1 |
| Medical laboratory | | | | 1 | | | | 1 |
| Bath-rooms | | | 1 | | | | | 1 |
| Totals | 3 | 37 | 45 | 44 | 3 | 3 | 2 | 137 |

# REPORT OF THE SUPERINTENDENT.

*Hon. Edwin Walden, President of the Public Water Board:*

SIR: — In compliance with the city ordinance I respectfully submit, herewith, the annual report of the Superintendent, for the year ending Dec. 31, 1881.

## PONDS.

The heavy rains and snows of the winter and spring, falling upon a frozen surface, yielded a more than usual percentage to the ponds, filling them both to their full capacity, causing a slight waste at Birch Pond, during the latter part of April, a part of May, and the early part of June. The total waste from this pond, up to the tenth of June, was six and a quarter millions of gallons; no waste occurred at Breed's Pond, up to that time. On the tenth of June, after more or less rain nearly every day, from the twenty-eighth of May up to that time, a heavy storm set in, causing a large volume of water to flow over the flash-boards at both ponds. The water in Birch Pond being very near the top of the dam, caused some anxiety, if the storm should continue, lest the force of the wind should drive the water over the dam. To remove all danger in that direction the waste-gate was partially opened, and kept open some eighteen hours, when, all danger having passed, the gate was closed, and the surplus water allowed to flow over the flash-boards. The total amount of waste from both ponds, over the flash-boards and through the gate, caused by this storm, was thirty-six millions of gallons; making the total waste for the year, from both ponds, 42,355,919 gallons.

At the upper end of Breed's Pond, where the road to Dungeon Rock passes along the margin of the pond, a substantial wall has been built, for a distance of three hundred feet, and the space filled, making a wide and substantial road at that point, and sufficiently high to be above the water level of the pond at all times. The bridge to the gate-house has been strengthened with iron rods, and the bridge and roof of the gate-house painted.

The only expense incurred at Birch Pond has been the painting of the bridges, and the roof of the gate-house. The water in Birch Pond has been kept somewhat higher than last year; although it was not used during the warm weather of the summer it has not been affected, as in previous years, but has remained sweet and palatable during the entire year. It was brought into use again in the fall, and during the last month the entire supply for the city has been taken from that pond. Both ponds are now in good condition, and the water is of a superior quality, comparing favorably with the water supplied to any city in the State.

## TUBULAR WELLS.

Pumping from the tubular wells was continued until the eleventh of March, when it became evident that the ponds would fill up, and the pumping was discontinued. The quantity pumped was 11,624,538 gallons in January; 10,898,168 gallons in February; 4,270,644 gallons in March; total, 27,093,350 gallons. In a few days after the pumping ceased the water began to flow from the pipe and has continued flowing to the present time. After the pumping had been stopped about a month, and the wells appeared to have regained their normal condition, a small weir was placed so that all the water flowing from the wells should pass over it; and gaugings taken and continued at intervals up to the present time, the mean of which give an average daily flow of 132,968 gallons. This amount indicates the natural flow from these wells. Nowithstanding the filling up of the wells in so short a time after pumping ceased, the wells at a distance of two thousand feet or more away, that were dried up by the pumping, have not returned to their former level up to the present time, showing that the ground water has not yet regained its former level. The boiler, engine and pump have been carefully kept in good condition, and are ready for service.

## QUALITY OF THE WATER.

On the twentieth of December, 1881, three samples of water were collected — one from Breed's Pond, one from Birch Pond, one from the tubular wells — and sent to Prof. W. R. Nichols, of the Massachusetts Institute of Technology, for examination. He being unable to make the examination, on account of ill-health, they were transferred to Dr. E. S. Wood, of Harvard Medical College, and the following report has been received from him:

BOSTON, *Jan, 10, 1882.*

ANALYSIS.

Figures express parts per 100,000 of water.

WATER FROM LYNN WATER BOARD.

| Location. | Chlorine. | Residue. | | | Hardness. English Degrees. |
|---|---|---|---|---|---|
| | | Fixed. | Volatile. | Total. | |
| I. Breed's Pond | 0.10 | 5.10 | 2.40 | 7.50 | 1 |
| II. Birch Pond | 0.20 | 1.70 | 3.30 | 5.00 | ½ |
| III. Tubular Wells | 2.50 | 11.90 | 4.30 | 16.20 | 4½ |

EDWARD S. WOOD.

THE ABOVE RESULTS REDUCED TO GRAINS PER U. S. GALLON.

| Location. | Chlorine. | Residue. | | |
|---|---|---|---|---|
| | | Fixed. | Volatile. | Total. |
| I. Breed's Pond . . . . . | 0.058 | 2.468 | 1.402 | 3.630 |
| II. Birch Pond . . . . . . | 0.117 | 0.823 | 1.927 | 2.420 |
| III. Tubular Wells . . . . | 1.160 | 5.760 | 2.081 | 7.841 |

## SUPPLY OF WATER.

On the first of January, 1881, the depth in Breed's Pond was eight feet five and one-half inches; the depth in Birch Pond was seven feet seven and one-half inches. On the first of January, 1882, the depth in Breed's Pond, was thirteen feet four inches; and the depth in Birch Pond, eleven feet five inches.

The rainfall for the year has been 46.31 inches; 9.03 inches more than the rainfall of last year. The yield of the watershed, available for consumption, has been 55.87 per cent. of the rainfall, equal to 25.87 inches over the drainage area, exclusive of water surfaces. The total consumption for the year has been 467,086,034 gallons, leaving a surplus received into the ponds of 138,262,844 gallons above the consumption. While the amount in store is much in excess of the last two years, it is much less than in either 1878 or 1879, and about the same as in 1877. The rainfall has been larger than in any year, except 1878, since the works were built, and the per centage collected, on account of the extremely favorable conditions, is larger than in any previous year. It should also be borne in mind that seventy-seven millions of gallons were pumped into the pond from the tubular wells; that if no water had been pumped from that source during the previous fall and winter, there would have been no waste and the ponds would not have been full by thirty-five millions of gallons, the difference between the amount wasted and the amount pumped. If the capacity of a water supply is to be determined by any one year, it should be by the year of low rainfall, as that is the contingency to be provided against; and not by a year of large rainfall. January 1, 1879, there was 116,000,000 gallons in store more than at this time, but in 1880 resort was had to the tubular wells to avoid the danger of a water famine. For the three years from 1879 to 1881, with a rainfall averaging 41.54 inches, the records give the total amount of water received into the ponds as 1,389,757,618 gallons; and the amount consumed for the same period as 1,380,818,523 gallons. As the consumption is constantly increasing, the same amount of water, if it could be insured for the next three years, will not be sufficient to supply the wants of our citizens.

The increase in the last two years has been as follows: Distributing mains, 8 miles, 390 feet; services, 802; families, 1292, about the same as the total number of families in Swampscott, Saugus and Nahant. The population increased from 1875 to 1880 17.43 per cent.; the same ratio of increase will give a population in 1885 of 45,000, which, at forty gallons per capita per diem, a very small estimate as compared with the actual consumption in other cities, will require 1,800,000 gallons per day, or 375,000 gallons more than the average daily yield of the ponds, since Birch Pond was built.

That we have escaped a water famine for the last few years is due to the economy of our citizens in the use of the public supply. Investigation shows that the consumption of water in Lynn is probably less than in any other city of its size in the United States. The following table has been compiled from the latest and most reliable information.

# TABLE

**Showing the number of inhabitants and the consumption of water in the year 1880, of all the cities and towns from 10,000 inhabitants to 50,000 inhabitants, for which the consumption is given in that year. Compiled from "The History and Statistics of American Water Works," by J. J. R. Cross, C. E.**

| City. | State. | Population. | Miles of pipe. | Number of services. | Average daily consumption. | Average per inhabitant. |
|---|---|---|---|---|---|---|
| **Patterson** | N. J. | 50,887 | 35 | 2,400 | 6,000,000 | 117.91 |
| **Toledo** | Ohio | 50,143 | 47 | 1,616 | 3,262,000 | 65.05 |
| **Quebec** | Canada | 50,000 | 28 | | 3,000,000 | 60.00 |
| **Fall River** | Mass. | 49,006 | 52 | 2,685 | 1,357,349 | 27.69 |
| **Minneapolis** | Minn. | 46,887 | 18 | 1,119 | 3,010,591 | 64.21 |
| **Nashville** | Tenn. | 43,461 | 42 | | 6,000,000 | 138.05 |
| **Hartford** | Conn. | 43,553 | 70 | 4,904 | 4,500,000 | 105.75 |
| **Wilmington** | Del. | 42,499 | 52 | 4,344 | 3,564,856 | 83.88 |
| **Lawrence** | Mass. | 39,178 | 41 | 7,001 | 1,861,363 | 47.51 |
| ***Lynn** | Mass. | 38,593 | 57 | 4,549 | 1,238,289 | 32.09 |
| **Salem and Beverly** | Mass. | 36,048 | | | 2,206,774 | 61.23 |
| **Halifax** | N. S. | 36,102 | 55 | | 5,000,000 | 138.46 |
| **Hamilton** | Canada | 35,009 | 65 | 8,200 | 1,800,000 | 51.41 |
| **Denver** | Col. | 35,630 | 30 | 2,500 | 2,125,000 | 59.64 |
| **Memphis** | Tenn. | 33,593 | 20 | 3,000 | 5,000,000 | 148.84 |
| **Manchester** | N. H. | 32,630 | 33 | 1,807 | 1,180,930 | 36.19 |
| **Grand Rapids** | Mich. | 32,015 | 22 | 819 | 1,107,427 | 34.59 |
| **Savannah** | Ga. | 30,681 | 22 | | 2,400,000 | 78.22 |
| **Peoria** | Ill. | 29,315 | 43 | 1,645 | 2,000,000 | 68.22 |
| **Erie** | Penn. | 27,730 | 35 | | 2,000,000 | 72.12 |
| **New Bedford** | Mass. | 26,875 | 42 | 3,798 | 2,014,200 | 74.94 |
| **Augusta** | Ga. | 23,023 | 22 | 1,650 | 2,400,000 | 104.25 |
| **Des Moines** | Iowa | 22,696 | 20 | | 1,300,000 | 57.28 |
| **Ottawa** | Canada | 22,000 | 43 | 5,656 | 3,292,000 | 149.63 |
| **Norfolk** | Va. | 21,966 | 21 | 1,303 | 707,934 | 32.23 |
| **Auburn** | N. Y. | 21,924 | 26 | | 2,600,000 | 118.59 |
| **Taunton** | Mass. | 21,213 | 33 | 1,608 | 510,261 | 24.05 |
| **London** | Canada | 21,000 | 36 | 500 | 1,250,000 | 59.52 |
| **Poughkeepsie** | N. Y. | 20,207 | 16 | 1,326 | 1,403,292 | 69.44 |
| **East Saginaw** | Mich. | 19,016 | 22 | 895 | 1,584,457 | 83.37 |
| **Yonkers** | N. Y. | 18,892 | 23 | 750 | 900,000 | 47.64 |
| **Meridan** | Conn. | 18,340 | 24 | 1,700 | 1,000,000 | 54.52 |
| **Zanesville** | Ohio | 18,120 | 34 | 2,388 | 1,947,000 | 107.45 |
| **Allentown** | Pa. | 18,063 | 18 | 2,400 | 1,000,000 | 55.36 |
| **Binghampton** | N. Y. | 17,315 | 24 | 2,360 | 1,700,000 | 98.18 |
| **Newton** | Mass. | 16,995 | 60 | 1,937 | 468,476 | 27.56 |
| **New Albany** | Ind. | 16,422 | 16 | 750 | 650,000 | 39.58 |
| **Jackson** | Mich. | 16,105 | 13 | 182 | 800,000 | 49.67 |
| **Lynchburg** | Va. | 15,959 | 13 | 750 | 1,250,000 | 78.32 |
| **Sandusky** | Ohio | 15,838 | 20 | 869 | 1,290,000 | 81.45 |
| **Leadville** | Col. | 14,820 | 3 | 250 | 1,000,000 | 67.47 |
| **Lockport** | N. Y. | 13,522 | 7 | 250 | 800,000 | 59.90 |
| **Pittsfield** | Mass. | 13,367 | 30 | 1,800 | 1,500,000 | 112.21 |
| **Nashua** | N. H. | 13,397 | 23 | 1,600 | 1,000,000 | 74.49 |
| **South Bend** | Ind. | 13,279 | 20 | 600 | 1,000,000 | 75.31 |
| **Kalamazoo** | Mich. | 11,937 | 16 | 575 | 803,468 | 67.31 |
| **Waltham** | Mass. | 11,711 | 23 | | 411,000 | 35.13 |
| **Saratoga** | N. Y. | 10,822 | 17 | 1,346 | 1,172,818 | 108.37 |
| **Port Huron** | Mich. | 10,000 | 19 | 1,037 | 500,254 | 50.02 |

***Including the families supplied in East Saugus and Swampscott.**

In the above forty-nine cities and towns the average daily consumption per inhabitant is 72.53 gallons. The average daily consumption in Lynn is 32.09, or 44¼ per cent. of the average in the above forty-nine cities. It will be seen from the above that in only three cities is the consumption per capita smaller than in Lynn, and in those cities, a comparison of the number of services would indicate a much larger number of actual consumers in Lynn, in proportion to the total population, than in either of them; consequently a smaller quantity, per actual consumer, than in any city in this country. Take the eighteen cities, including Lynn, whose population ranges from 30,000 to 50,000, and the nearest to us in size, and the average daily consumption, per capita, is increased to 75.04 gallons. Take our nearest neighbor, Salem, for comparison, and the case stands thus: Salem and Beverly, with a population of 36,043, have a daily average consumption of 2,206,774 gallons. Lynn, with a population, including the families in Saugus and Swampscott supplied from our works, of 38,593, has a daily average consumption of 1,238,289 gallons.

The large rainfall of the year, and the favorable conditions for a large per centage finding its way to the ponds, together with the large capacity of the storage reservoirs, has not only given an abundant supply for the year, but a considerable surplus toward the supply of the coming year. If a large rainfall could be insured for the two or three succeeding years, our supply might still be sufficient for our wants. On the contrary, if the rainfall should fall much below the average, for the two or three coming years, we shall be likely to be in a situation where even the tubular wells will not save us from a water famine. In view of all the facts, a prudent regard for the best interests of our prosperous and rapidly growing city requires that early action should be taken to avoid the danger that threatens in the near future.

## RESERVOIR.

A new bridge from the embankment to the gate-house has been erected. The road has been put in good repair, and the walk on the top of the embankment cleaned of weeds, grass, etc. The coming year a new chamber to the gates, outside the embankment, will be required. I would respectfully recommend that a brick chamber be built, and a small house erected over it, as rendering a better protection to the gates, and as being more convenient and easy of access.

## PUMPING STATION.

The buildings at the pumping station are in good order, and require no outlay at present. Some slight repairs have been made during the year to the doors and windows, where it was needed. The grounds remain in the same unfinished condition, for the want of a proper fence to protect them. The boilers and furnaces have received some slight repairs, and are now in good condition. The engine has required no repairs; it is in good working order, does its work well and with apparent ease; and still maintains its high standard of duty. It has been run during the

[illegible]

## PIPES

[illegible] and 4 inches in size [illegible] of smaller sizes [illegible] 74 [illegible] have been [illegible] 42 [illegible] of pipe laid [illegible] lineal feet of [illegible] Three services [illegible] and one hydrant [illegible] connection has been made [illegible] Willow street, to connect with [illegible] Keene Brothers, for [illegible] different parties have been [illegible] has been paid for by the [illegible] work was done.

[illegible] private parties in 1870 [illegible] renewed; 6 shallow services [illegible] leaks, on pipes of all sizes.

have been repaired; 4 gates and 41 hydrants have been repaired; and 2 hydrants, broken by teams, have been replaced with new ones. Every hydrant in the city has been carefully examined, and all necessary repairs made; and all hydrants, gates and pipes, so far as they can be examined without digging them up, are believed to be in good working condition. One hundred and fifty-four new stop-boxes, on services, and 24 new gate-boxes have been set to replace the same number that were rotted out; 16 new meters have been set at factories; and over 100 meters have been taken out, cleaned and repaired when necessary, and reset.

For more full particulars of the work done, please see the annexed tables; also tables showing the engine record for the year, with cost of pumping, rainfall, consumption of water, standing of the ponds, meteorological record for the year, etc.

All of which is respectfully submitted,

DANIEL WALDEN,
*Superintendent.*

# TABLE I.

## ENGINE RECORD FOR THE YEAR ENDING DECEMBER 31, 1881.

| Month. | Number of pumping days. | Average pumping time per day. | | Total pumping time per month. | | Total number of revolutions per month. | Average revolutions per minute. | Coal consumed. | | | | Ashes and cinders. | Ashes and cinders. | Total number of gallons pumped per month, allowing 4 per cent. for loss of action in the pump. | Average number of gallons pumped into the reservoir per pound of coal. | Average number of gallons raised 100 feet high per pound of coal. | Average head against the pump. | Average duty in pounds of water raised one foot high per 100 lbs. of coal, calculated on the total coal consumed, no deduction made for ashes and cinders. | Average duty calculated on the total coal consumed, ashes and cinders being deducted. | Average duty calculated on the coal consumed while running, no deduction being made for ashes and cinders. | Average duty calculated on the coal consumed while running, the ashes and cinders deducted. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Raising steam | Pumping. | Banking | Total. | | | | | | | | | | |
| | Dys. | H. | M. | H. | M. | Revs. | Rev. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | p. c. | Gallons. | Galls | Galls. | Feet. | Pounds. | Pounds. | Pounds. | Pounds. |
| January... | 11 | 15 | 30 | 170 | 30 | 190,260 | 18.33 | 9,400 | 43,600 | 2,100 | 55,100 | 7,300 | 13.25 | 35,493.003 | 644.15 | 1,069.94 | 166.10 | 92,902,006 | 107,089,973 | 117,405,980 | 135,334,727 |
| February.. | 16 | 13 | 14 | 211 | 45 | 236,490 | 18.61 | 11,800 | 53,150 | 3,000 | 68,850 | 9,500 | 13.80 | 44,117,209 | 640.77 | 1,061.18 | 165.61 | 92,141,593 | 106,890,457 | 119,359,335 | 138,684,055 |
| March..... | 12 | 14 | 41 | 176 | 10 | 194,460 | 18.39 | 10,700 | 44,000 | 2,100 | 56,800 | 7,500 | 13.20 | 36,276,513 | 638.67 | 1,062.01 | 166.29 | 92,213,409 | 106,241,818 | 119,039,128 | 137,145,444 |
| April...... | 14 | 12 | 43 | 178 | 00 | 198,500 | 18.59 | 11,200 | 43,700 | 2,700 | 57,600 | 7,700 | 13.37 | 37,030,175 | 642.88 | 1,073.15 | 166.93 | 93,179,018 | 107,557,744 | 122,817,195 | 141,777,469 |
| May....... | 12 | 12 | 40 | 152 | 00 | 170,145 | 18.65 | 10,000 | 37,700 | 2,400 | 50,100 | 6,500 | 12.97 | 31,740,549 | 633.54 | 1,056.24 | 166.73 | 91,715,851 | 105,389,085 | 121,882,337 | 140,051,941 |
| June....... | 13 | 13 | 51 | 180 | 00 | 199,320 | 18.45 | 11,300 | 45,350 | 2,400 | 59,050 | 8,000 | 13.55 | 37,183,146 | 629.69 | 1,049.82 | 166.72 | 91,152,763 | 105,437,232 | 118,689,541 | 137,289,463 |
| July....... | 16 | 13 | 01 | 208 | 20 | 232,745 | 18.02 | 12,400 | 51,300 | 3,600 | 67,300 | 9,000 | 13.37 | 43,418,579 | 645.15 | 1,074.82 | 166.60 | 93,323,526 | 107,730,245 | 122,430,473 | 141,829,282 |
| August.... | 17 | 12 | 21 | 210 | 00 | 233,375 | 18.52 | 13,700 | 50,700 | 3,600 | 68,000 | 9,200 | 13.53 | 43,536,106 | 640.24 | 1,064.85 | 166.32 | 92,458.754 | 106,925,090 | 124,007,797 | 143,411,312 |
| September. | 18 | 12 | 14 | 220 | 10 | 245,705 | 18.60 | 13,500 | 55,000 | 4,100 | 72,600 | 9,500 | 13.08 | 45,836,267 | 631.35 | 1,049.24 | 166.19 | 91,102,439 | 104,818,337 | 120,255,219 | 138,360,293 |
| October.... | 15 | 12 | 11 | 182 | 45 | 204,770 | 18.67 | 11,800 | 45,100 | 3,300 | 60,200 | 8,500 | 14.12 | 38,199,843 | 634.55 | 1,055.76 | 166.38 | 91,667,882 | 106,739,005 | 122,357,129 | 142,476,653 |
| November. | 14 | 11 | 54 | 166 | 40 | 186,135 | 18.61 | 12,400 | 42,250 | 2,700 | 57,350 | 7,900 | 13.77 | 34,723,484 | 605.47 | 1,005.38 | 166.05 | 87,295,315 | 101,241,382 | 118,496,718 | 137,424,824 |
| December.. | 16 | 12 | 05 | 193 | 25 | 216,145 | 18.62 | 13,900 | 47,750 | 3,600 | 65,250 | 9,000 | 13.79 | 40,321,849 | 617.96 | 1,028.96 | 166.52 | 89,669,206 | 104,010,945 | 122,532,265 | 142,136,711 |
| Tots & av's | 174 | 13 | 02 | 2249 | 45 | 2,508,050 | 18.58 | 142,100 | 559,000 | 36,500 | 738,200 | 99,600 | 13.49 | 467,876,723 | 633.70 | 1,054.28 | 166.37 | 91,568,480 | 105,939,276 | 120,772,709 | 139,618,514 |

## COST OF PUMPING.

| | | |
|---|---|---|
| 738,200 pounds of coal, average price per net ton, \$5.97½ | | \$2,205 46 |
| 31,600 pounds of coal, for heating, average price per net ton, \$5.85½ | | 92 64 |
| 12 cords of wood, at \$4.50 | | 54 00 |
| Oil, waste, packing, &c | | 147 76 |
| Sundries | | 20 01 |
| Repairs on boilers and furnaces | | 129 80 |
| Wages of engineer and fireman | | 1,985 75 |
| Total | | \$4,685 42 |
| Cost of raising one million gallons into the roservoir | \$9 90$\frac{73}{100}$ | |
| Cost of raising one million gallons one foot high | \$0 05$\frac{85}{100}$ | |

## TABLE II.

### SHOWING THE CONSUMPTION OF WATER FOR THE YEAR ENDING DECEMBER 31, 1881.

| | Monthly consumption. | Average consumption per day. | Average daily increase. | Average daily decrease. | Average to each consumer. | Average to each inhabitant. |
|---|---|---|---|---|---|---|
| Month. | Gallons. | Gallons. | Gallons. | Gallons. | Galls. | Galls. |
| January..... | 37,432,676 | 1,207,505 | 87,841 | | 45.2 | 30.5 |
| February.... | 43,355,197 | 1,548,400 | 340,895 | | 57.9 | 39.1 |
| March...... | 35,895,507 | 1,157,920 | | 390,480 | 43.3 | 29.2 |
| April........ | 33,932,288 | 1,131,076 | | 26,844 | 42.3 | 28.5 |
| May........ | 36,839,904 | 1,188,384 | 57,308 | | 44.5 | 29.9 |
| June....... | 37,120,592 | 1,237,353 | 48,969 | | 46.3 | 31.2 |
| July....... | 42,355,154 | 1,366,295 | 128,942 | | 51.1 | 34.5 |
| August...... | 46,436,326 | 1,497,946 | 131,651 | | 56.1 | 37.8 |
| September.. | 41,518,005 | 1,383,933 | | 114,013 | 51.8 | 34.9 |
| October..... | 40,760,904 | 1,314,868 | | 69,065 | 49.2 | 33.2 |
| November... | 35,917,698 | 1,197,256 | | 117,612 | 44.8 | 30.2 |
| December... | 35,521,783 | 1,145,864 | | 51,392 | 42.9 | 28.9 |
| To. and av. | 467,086,034 | 1,279,688 | | | 47.9 | 32.3 |

# TABLE III.

### SHOWING THE AMOUNT OF RAINFALL ON THE WATER SHED OF BREED'S AND BIRCH PONDS, AMOUNT OF WATER DRAWN FROM THE PONDS, AMOUNT WASTED FROM THE PONDS. AMOUNT RECEIVED INTO THE PONDS, AND PERCENTAGE OF RAINFALL AVAILABLE FOR USE, FROM 1874 TO 1881, BOTH INCLUSIVE.

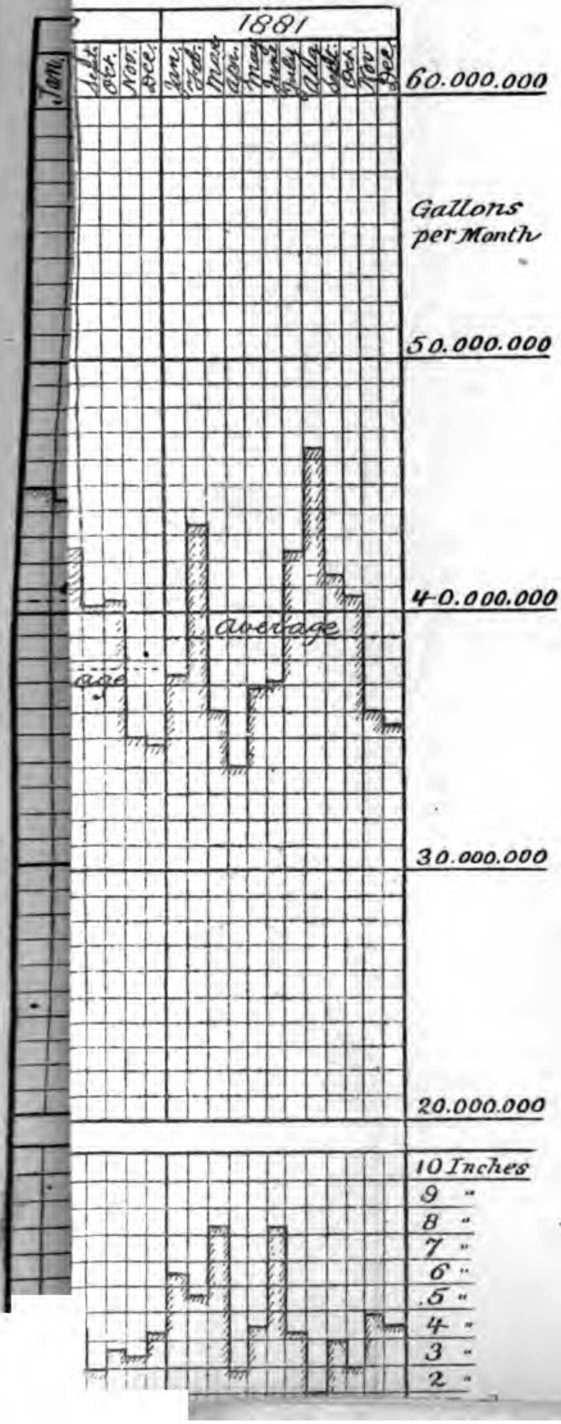
| Date. | Rainfall. | Amount of rainfall on the water shed of the ponds. | Amount of water drawn from the ponds for consumption. | Amount of water wasted from the ponds. | Total amount consumed and wasted in the year. | Increase in the ponds during the year. | Decrease in the ponds during the year. | Total amount of the rainfall received into the ponds. | Daily average. | Percentage of rainfall received into the ponds. |
|---|---|---|---|---|---|---|---|---|---|---|
| Year. | Inches. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Per ct. |
| 1874 | 34.92 | 837.151.949 | 485,189,801 | 21.200,000 | 506,389.801 | | 47,545,394 | 458,844.407 | 1,257,108 | 54.81 |
| 1875 | 41.85 | 1,003.305,644 | 471,387,757 | 11,609,267 | 482,997,024 | 60,281.293 | | 543,278.317 | 1,488,433 | 54.24 |
| 1876 | 45.05 | 1,080,099,392 | 395.084,629 | 20.500,000 | 415,584.629 | 74,452,111 | | 490,036,740 | 1,342,566 | 45.37 |
| 1877 | 45.65 | 1,094.483,734 | 402,161.193 | 131,271,511 | 533.438,704 | 60,846,704 | | 594,285,408 | 1,628,179 | 54.29 |
| 1878 | 57.36 | 1,379,911.034 | 417,678,296 | 205,081,247 | 622.759,543 | 64.712,199 | | 687,471,742 | 1,883,484 | 49.82 |
| 1879 | 41.04 | 983,957.360 | 456,319,019 | 164,095,022 | 620,414,041 | | 205,370,014 | 417,044,027 | 1,142,586 | 42.88 |
| 1880 | 37.28 | 893,809,219 | 401,905,570 | | 401,905,570 | | 49,803,426 | 352,102,144 | 964,663 | 39.38 |
| 1881 | 46.31 | 1,110,771.709 | 439,992,684 | 42,355,919 | 482,348,603 | 138,262,844 | | 620,611,447 | 1,700,305 | 55.87 |

# TABLE IV.

## SHOWING THE DEPTH OF WATER IN THE PONDS FOR EACH WEEK DURING THE YEAR 1881.

| Date. | | Breed's Pond. | | Birch Pond. | | Date. | | Breed's Pond. | | Birch Pond. | | Date. | | Breed's Pond. | | Birch Pond. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ft. | In. | Ft. | In. | | | Ft. | In. | Ft. | In. | | | Ft. | In. | Ft. | In. |
| Jan. | 1 | 8 | 5½ | 7 | 7½ | May | 7 | 20 | 6 | 14 | 4 | Sept. | 10 | 16 | 5½ | 13 | 2½ |
| | 8 | 8 | 7½ | 7 | 7 | | 14 | 20 | 4 | 14 | 2½ | | 17 | 15 | 11 | 13 | 1½ |
| | 15 | 9 | 5 | 7 | 11 | | 21 | 20 | 8 | 14 | 6 | | 24 | 15 | 5 | 13 | 1 |
| | 22 | 10 | | 8 | 3½ | | 28 | 20 | 7 | 14 | 6¾ | Oct. | 1 | 14 | 9½ | 13 | |
| | 29 | 9 | 11½ | 8 | 2 | June | 4 | 20 | 7¼ | 14 | 7¼ | | 8 | 14 | 4 | 12 | 10½ |
| Feb. | 5 | 9 | 10 | 8 | | | 11 | 21 | 2 | 14 | 6½ | | 15 | 13 | 9 | 12 | 9 |
| | 12 | 10 | 4½ | 8 | 6½ | | 18 | 20 | 11 | 14 | 7 | | 22 | 13 | 2 | 12 | 8½ |
| | 19 | 11 | 7½ | 9 | ½ | | 25 | 20 | 7½ | 14 | 5½ | | 29 | 12 | 8½ | 12 | 8 |
| | 26 | 12 | 6 | 9 | 2 | July | 2 | 20 | 7½ | 14 | 7¼ | Nov. | 5 | 12 | 4 | 12 | 9 |
| Mar. | 5 | 14 | 7 | 10 | 6½ | | 9 | 20 | 4 | 14 | 5 | | 12 | 12 | | 12 | 8½ |
| | 12 | 18 | 3 | 12 | 8 | | 16 | 20 | 1 | 14 | ½ | | 19 | 11 | 10 | 12 | 9½ |
| | 19 | 19 | 2½ | 13 | 3½ | | 23 | 19 | 10½ | 13 | 9 | | 26 | 11 | 10 | 12 | 8½ |
| | 26 | 19 | 11 | 13 | 10½ | | 30 | 19 | 8 | 13 | 7½ | Dec. | 3 | 12 | | 12 | 3½ |
| April | 2 | 20 | 1 | 14 | 2 | Aug. | 6 | 19 | 2 | 13 | 6½ | | 10 | 12 | 2 | 12 | |
| | 9 | 20 | 1½ | 14 | 4 | | 13 | 18 | 7 | 13 | 5½ | | 17 | 12 | 4½ | 11 | 8½ |
| | 16 | 20 | 4½ | 14 | 6 | | 20 | 18 | | 13 | 4 | | 24 | 12 | 7 | 11 | 5 |
| | 23 | 20 | 6½ | 14 | 5 | | 27 | 17 | 5½ | 13 | 3 | | 31 | 13 | 3 | 11 | 4½ |
| | 30 | 20 | 7 | 14 | 4 | Sept. | 3 | 17 | | 13 | 3½ | | | | | | |

## AST 8 YEARS.

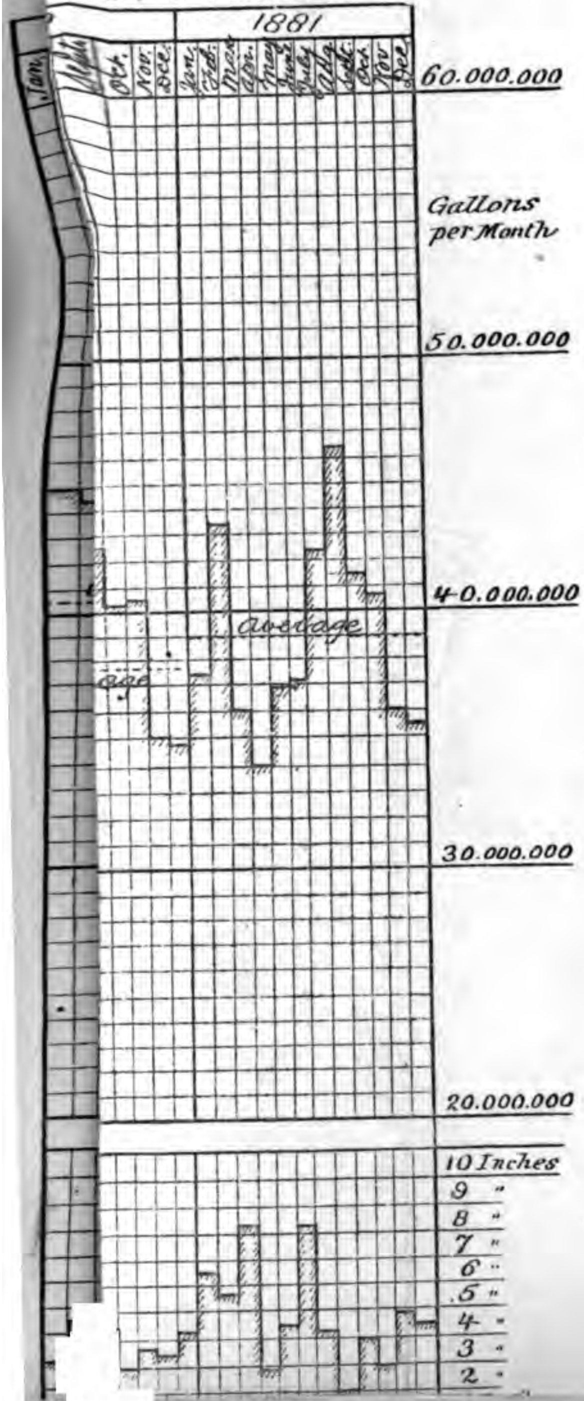

1881
Jan.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
60.000.000
Gallons per Month
50.000.000
40.000.000
Average
age
30.000.000
20.000.000
10 Inches
9 "
8 "
7 "
6 "
5 "
4 "
3 "
2 "

## TABLE IV.

### SHOWING THE DEPTH OF WATER IN THE PONDS FOR EACH WEEK DURING THE YEAR 1881.

| Date. | | Breed's Pond. | | Birch Pond. | | Date. | | Breed's Pond. | | Birch Pond. | | Date. | | Breed's Pond. | | Birch Pond. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ft. | In. | Ft. | In. | | | Ft. | In. | Ft. | In. | | | Ft. | In. | Ft. | In. |
| Jan. | 1 | 8 | 5½ | 7 | 7½ | May | 7 | 20 | 6 | 14 | 4 | Sept. | 10 | 16 | 5½ | 13 | 2½ |
| | 8 | 8 | 7½ | 7 | 7 | | 14 | 20 | 4 | 14 | 2½ | | 17 | 15 | 11 | 13 | 1½ |
| | 15 | 9 | 5 | 7 | 11 | | 21 | 20 | 8 | 14 | 6 | | 24 | 15 | 5 | 13 | 1 |
| | 22 | 10 | | 8 | 3½ | | 28 | 20 | 7 | 14 | 6¾ | Oct. | 1 | 14 | 9½ | 13 | |
| | 29 | 9 | 11½ | 8 | 2 | June | 4 | 20 | 7¼ | 14 | 7¼ | | 8 | 14 | 4 | 12 | 10½ |
| Feb. | 5 | 9 | 10 | 8 | | | 11 | 21 | 2 | 14 | 6½ | | 15 | 13 | 9 | 12 | 9 |
| | 12 | 10 | 4½ | 8 | 6½ | | 18 | 20 | 11 | 14 | 7 | | 22 | 13 | 2 | 12 | 8½ |
| | 19 | 11 | 7½ | 9 | ½ | | 25 | 20 | 7½ | 14 | 5½ | | 29 | 12 | 8½ | 12 | 8 |
| | 26 | 12 | 6 | 9 | 2 | July | 2 | 20 | 7½ | 14 | 7¼ | Nov. | 5 | 12 | 4 | 12 | 9 |
| Mar. | 5 | 14 | 7 | 10 | 6½ | | 9 | 20 | 4 | 14 | 5 | | 12 | 12 | | 12 | 8½ |
| | 12 | 18 | 3 | 12 | 8 | | 16 | 20 | 1 | 14 | ½ | | 19 | 11 | 10 | 12 | 9½ |
| | 19 | 19 | 2½ | 13 | 3½ | | 23 | 19 | 10½ | 13 | 9 | | 26 | 11 | 10 | 12 | 8½ |
| | 26 | 19 | 11 | 13 | 10½ | | 30 | 19 | 8 | 13 | 7½ | Dec. | 3 | 12 | | 12 | 3½ |
| April | 2 | 20 | 1 | 14 | 2 | Aug. | 6 | 19 | 2 | 13 | 6½ | | 10 | 12 | 2 | 12 | |
| | 9 | 20 | 1½ | 14 | 4 | | 13 | 18 | 7 | 13 | 5½ | | 17 | 12 | 4½ | 11 | 8½ |
| | 16 | 20 | 4½ | 14 | 6 | | 20 | 18 | | 13 | 4 | | 24 | 12 | 7 | 11 | 5 |
| | 23 | 20 | 6½ | 14 | 5 | | 27 | 17 | 5½ | 13 | 3 | | 31 | 13 | 3 | 11 | 4½ |
| | 30 | 20 | 7 | 14 | 4 | Sept. | 3 | 17 | | 13 | 3½ | | | | | | |

AST 8 YEARS.


1881
Jan.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
60.000.000
Gallons per Month
50.000.000
40.000.000
Average
age
30.000.000
20.000.000
10 Inches
9 "
8 "
7 "
6 "
5 "
4 "
3 "
2 "

# TABLE V.

## SHOWING THE RAINFALL AT THE PUMPING STATION FOR THE YEAR 1881.

| Day of the Month. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .... | .... | .22 | .... | .05 | .10 | .37 | .... | .... | .... | .... | .30 |
| 2 | .... | .... | .15 | .... | .06 | .... | .... | .17 | 1.86 | .22 | .05 | .... |
| 3 | .... | .... | .25 | .... | .... | .60 | .... | .... | .08 | .30 | .33 | .10 |
| 4 | .22 | .... | 1.20 | .... | .... | .22 | .10 | .... | .... | .... | .21 | .01 |
| 5 | .57 | .... | .... | .04 | .06 | .26 | .... | .... | .... | .... | .... | .... |
| 6 | .31 | .... | .... | .... | .40 | .... | .... | .... | .... | .... | .... | .... |
| 7 | .... | .... | .... | .... | .... | .10 | .35 | .22 | .... | .... | .... | .28 |
| 8 | .... | .... | .... | .... | .... | .05 | .... | .... | .... | .... | .08 | .... |
| 9 | 1.10 | .... | 2.40 | .... | .... | .38 | .... | .05 | .03 | .... | .15 | .... |
| 10 | 1.21 | .09 | .65 | .... | .... | 2.91 | .... | .... | .14 | .... | .... | .... |
| 11 | .... | .... | .03 | .... | .... | .05 | .42 | .... | .06 | .... | .... | .... |
| 12 | .... | 1.62 | .18 | .13 | .... | .... | .... | .... | .07 | .... | .45 | .03 |
| 13 | .... | .... | .04 | .42 | .... | .01 | .... | .... | .03 | .... | .... | .... |
| 14 | .16 | .... | .03 | .75 | .34 | .05 | .... | .11 | .... | .... | .02 | .34 |
| 15 | .... | .24 | .... | .10 | .23 | .... | .... | .... | .... | .... | .05 | .... |
| 16 | .... | .33 | .... | .... | .26 | .... | .... | .... | .... | .... | .... | .... |
| 17 | .... | .... | .... | .... | .39 | .... | .... | .10 | .... | .02 | .... | .... |
| 18 | .... | .77 | .... | .... | .75 | .... | .05 | .15 | .... | .19 | .75 | .... |
| 19 | .02 | .... | .96 | .... | .21 | .... | .... | .02 | .... | .... | 1.15 | .... |
| 20 | .... | .... | .23 | .... | .... | .10 | .11 | .... | .... | .... | .... | .... |
| 21 | 1.82 | .70 | .... | .... | .... | .03 | .57 | .03 | .... | .... | .... | .... |
| 22 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .54 |
| 23 | .... | .13 | .01 | .... | .... | .... | .... | .03 | .72 | .... | .55 | .20 |
| 24 | .... | .05 | .... | .... | .... | .... | .... | .... | .... | .03 | .... | .... |
| 25 | .... | .06 | .... | .... | .... | .22 | .58 | .... | .... | .... | .... | .... |
| 26 | .... | .... | .... | .03 | .... | .40 | .60 | .... | .... | .... | .... | .38 |
| 27 | .... | .50 | .... | .... | .... | .47 | .... | .... | .01 | .... | .... | .58 |
| 28 | .... | .21 | .... | .19 | .... | .23 | .... | .... | .... | .... | .... | .01 |
| 29 | .... | .... | .... | .20 | .02 | .64 | .... | .... | .... | .25 | .... | .64 |
| 30 | .01 | .... | 1.00 | .... | .73 | .29 | .... | .... | .... | .06 | .05 | .... |
| 31 | .... | .... | .06 | .... | .... | .... | .20 | .... | .... | .86 | .... | .... |
| **Totals** | 5.42 | 4.70 | 7.31 | 1.86 | 3.50 | 7.11 | 3.35 | .88 | 3.00 | 1.93 | 3.84 | 3.41 |

## TABLE V.

### SHOWING THE RAINFALL AT THE PUMPING STATION FOR THE YEAR 1881.

| Day of the Month. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .... | .... | .22 | .... | .05 | .10 | .37 | .... | .... | .... | .... | .30 |
| 2 | .... | .... | .15 | .... | .06 | .... | .... | .17 | 1.86 | .22 | .05 | .... |
| 3 | .... | .... | .25 | .... | .... | .60 | .... | .... | .08 | .30 | .33 | .10 |
| 4 | .22 | .... | 1.20 | .... | .... | .22 | .10 | .... | .... | .... | .21 | .01 |
| 5 | .57 | .... | .... | .04 | .06 | .26 | .... | .... | .... | .... | .... | .... |
| 6 | .31 | .... | .... | .... | .40 | .... | .... | .... | .... | .... | .... | .... |
| 7 | .... | .... | .... | .... | .... | .10 | .35 | .22 | .... | .... | .... | .28 |
| 8 | .... | .... | .... | .... | .... | .05 | .... | .... | .... | .... | .08 | .... |
| 9 | 1.10 | .... | 2.40 | .... | .... | .38 | .... | .05 | .03 | .... | .15 | .... |
| 10 | 1.21 | .09 | .55 | .... | .... | 2.91 | .... | .... | .14 | .... | .... | .... |
| 11 | .... | .... | .03 | .... | .... | .05 | .42 | .... | .06 | .... | .... | .... |
| 12 | .... | 1.62 | .18 | .13 | .... | .... | .... | .... | .07 | .... | .45 | .03 |
| 13 | .... | .... | .04 | .42 | .... | .01 | .... | .... | .03 | .... | .... | .... |
| 14 | .16 | .... | .03 | .75 | .34 | .05 | .... | .11 | .... | .... | .02 | .34 |
| 15 | .... | .24 | .... | .10 | .23 | .... | .... | .... | .... | .... | .05 | .... |
| 16 | .... | .33 | .... | .... | .26 | .... | .... | .... | .... | .... | .... | .... |
| 17 | .... | .... | .... | .... | .39 | .... | .... | .10 | .... | .02 | .... | .... |
| 18 | .... | .77 | .... | .... | .75 | .... | .05 | .15 | .... | .19 | .75 | .... |
| 19 | .02 | .... | .96 | .... | .21 | .... | .... | .02 | .... | .... | 1.15 | .... |
| 20 | .... | .... | .23 | .... | .... | .10 | .11 | .... | .... | .... | .... | .... |
| 21 | 1.82 | .70 | .... | .... | .... | .03 | .57 | .03 | .... | .... | .... | .... |
| 22 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .54 |
| 23 | .... | .13 | .01 | .... | .... | .... | .... | .03 | .72 | .... | .55 | .20 |
| 24 | .... | .05 | .... | .... | .... | .... | .... | .... | .... | .03 | .... | .... |
| 25 | .... | .06 | .... | .... | .... | .22 | .58 | .... | .... | .... | .... | .... |
| 26 | .... | .... | .... | .03 | .... | .40 | .60 | .... | .... | .... | .... | .38 |
| 27 | .... | .50 | .... | .... | .... | .47 | .... | .... | .01 | .... | .... | .58 |
| 28 | .... | .21 | .... | .19 | .... | .23 | .... | .... | .... | .... | .... | .01 |
| 29 | .... | .... | .... | .20 | .02 | .64 | .... | .... | .... | .25 | .... | .64 |
| 30 | .01 | .... | 1.00 | .... | .73 | .29 | .... | .... | .... | .06 | .05 | .... |
| 31 | .... | .... | .06 | .... | .... | .... | .20 | .... | .... | .86 | .... | .... |
| **Totals.** | 5.42 | 4.70 | 7.31 | 1.86 | 3.50 | 7.11 | 3.35 | .88 | 3.00 | 1.93 | 3.84 | 3.41 |

## TABLE VI.

### SHOWING THE AMOUNT AND SIZE OF PIPE LAID DURING THE YEAR 1881.

| Streets where laid. | | | Size of pipe | |
|---|---|---|---|---|
| Street. | From. | To | 6 | 4 |
| Boston | Lynnfield | Cemetery | 2.053.03 | |
| Pendexter | Boston | Savory | 883.10 | |
| Adams | Sheridan | | 314.05 | |
| Sheridan | Extension | Adams | | 54 |
| Jefferson | Rockaway | | 475.06 | |
| Jackson | Marianna | | 375.04 | |
| Rockingham | Western ave | | 387 | |
| | | | | C. I.-18 |
| Michigan ave | Extension | Superior | | 731.09 |
| Autumn | Stephen | Bloomfield | | 396.03 |
| Eveline | Oakwood ave | | | 399 |
| Logan | Chestnut | Fayette | | 386.06 |
| Fayette | Logan | Marianna | | 92 |
| Marianna | Fayette | Chatham | | 660.05 |
| Sewall | Chatham | Empire | | 524.06 |
| Hancock | Extension | Everett | 70.09 | |
| Everett | Hancock | Lovers Leap ave. | 680 | |
| Lover's Leap ave. | Everett | Woodlawn | 272 | |
| Woodlawn | Tapley | | 393.06 | |
| Tapley | Woodlawn | Ontario | 793 | |
| Ontario | Tapley | | 270.09 | |
| Pine Grove ave | Tapley | | 240.01 | |
| Beacon Hill ave | Washington | High Rock ave | 645 | |
| High Rock ave | Extension | Beacon Hill ave. | 47 | |
| Buffum avenue | Washington | High Rock ave | 716.06 | |
| Nottingham | Western ave | Maple | | 419 |
| Nottingham | Western ave | | | 550 |
| French | Chestnut | | | 138.06 |
| Clough | Chestnut | Goldthwait | | 353.04 |
| Woodman | Cottage | End of street | 685.09 | |
| Robinson | Boston | Walnut | 1.567 | |
| Maple | Chatham | | 1.035.08 | |
| Glenwood | Chatham | | 438.07 | |
| Lilly | Sheridan | | | 120 |
| Bowler | Chestnut | | | 225.06 |
| Astor | Summer | Neptune | | 558.06 |
| Savory | Pendexter | Douglas | 301.07 | |
| Douglas | Savory | Roanoke | 364.04 | |
| Roanoke | Douglas | Jenness | 166 | |
| | | | C. I.-48 | |
| Waterhill | Federal | Cottage | 1,700.10 | |
| Cottage | Extension | Waterhill | 39 | |
| Murray | Waterhill | End of street | | 816 |
| May | Extension | Waterhill | | 29 |
| Total | | | 14,964.08 | 5,572.03 |

## TABLE VI.—Continued.

| Name of Court. | Size of Pipe. | | | |
|---|---|---|---|---|
| | 2 | 1 1-2 | 1 1-4 | 1 |
| Maple street-court | | 132.06 | | |
| Dennison court | | 194.08 | | |
| Summer-street court | | | 201.06 | |
| Sutton-street extension | 44 | | | |
| Harbor-street court | | 271.03 | | 41 |
| Edwards court | 98.05 | 146.05 | 38.03 | |
| Jewett court | 197.08 | 89.07 | | |
| Hilton court | 161 | 102.03 | | |
| Alton court | | | 140.10 | |
| Buckley court | | | 177 | 4.08 |
| Marion street | 215.01 | 56.02 | | |
| Neptune street | 258.05 | | | |
| Towns court | 350 | 121.09 | | |
| Savory court | 79.10 | 48 | | |
| Ezra street | 71.04 | 65.03 | 25 | 10.06 |
| Total | 1,475.09 | 1,227.10 | 582.07 | 56.02 |

| | | |
|---|---|---|
| Total extension in 1881 | 4 miles, | 2,759 feet. |
| Previously laid | 55 miles, | 4,451 feet. |
| Total pipe laid to January 1, 1882 | 60 miles, | 1,930 feet. |
| Total pipe laid in Saugus | 1 mile, | 530 feet. |
| Total pipe laid in Swampscott | | 1,778 feet. |
| Total pipe laid in connection with the works | 61 miles, | 4,228 feet. |

# TABLE VII.

## SHOWING THE LOCATION AND SIZE OF GATES SET IN 1891.

| Street. | Location. | Size. |
|---|---|---|
| Astor ......... | 11 1-2 feet W. from the E. line of Astor Street.<br>On the line of the S. line of Summer Street..... | 4 |
| Astor ......... | 10 feet W. from the E. line of Astor Street.<br>1 foot N. from the N. line of Neptune Street.... | 4 |
| Boston ........ | 35 feet S. from the N. line of Boston Street.<br>On the line of the E. line of Lynnfield Street.... | 6 |
| Beacon Hill Av. | 16 1-2 feet S. from the N. line of Beacon Hill Ave.<br>On the line of the E. line of Washington Street. | 6 |
| Beacon Hill Av | 16 1-2 feet S. from the N. line of Beacon Hill Ave.<br>On the line of the W. line of High Rock Ave.... | 6 |
| Buffum Avenue. | 16 1-2 feet S. from the N. line of Buffum Avenue.<br>On the line of the E. line of Washington Street. | 6 |
| Buffum Avenue. | 17 feet S. from the N. line of Buffum Avenue.<br>On the line of the W. line of High Rock Ave.... | 6 |
| Bowler ........ | 19 feet N. from the S. line of Bowler Street.<br>On the line of the E. line of Chestnut Street.... | 4 |
| Clough ........ | 18 feet S. from the N. line of Clough Street.<br>On the line of the E. line of Chestnut Street.... | 4 |
| Evelyn ........ | 17 feet E. from the W. line of Evelyn Street.<br>On the line of the N. line of Oakwood Avenue.. | 4 |
| Everett ........ | 17 feet N. from the S. line of Everett Street.<br>On the line of the E. line of Lovers Leap Ave.. | 6 |
| Everett ........ | 17 feet E. from the W. line of Everett Street.<br>On the line of the N. line of Hancock Street.... | 6 |
| Empire ........ | 17 feet E. from the W. line of Empire Street.<br>On the line of the S. line of Sewall Street....... | 4 |
| French......... | 33 1-2 feet N. from the S. line of French Street.<br>On the line of the E. line of Chestnut Street.... | 4 |
| Glenwood...... | 16 feet N. from the S. line of Glenwood Street.<br>On the line of the E. line of Chatham Street.... | 6 |
| Jackson ....... | 14 feet E. from the W. line of Jackson Street.<br>On the line of the N. line of Marrianna Street... | 6 |
| Jefferson...... | 16 feet N. from the S. line of Jefferson Street.<br>On the line of the E. line of Rockaway Street... | 6 |
| Logan ......... | 18 1-2 feet N. from the S. line of Logan Street.<br>On the line of the E. line of Chestnut Street.... | 4 |
| Lovers Leap Av. | 17 feet E. from the W. line of Lovers Leap Ave.<br>1 foot S. from the S. line of Woodlawn Street.. | 6 |
| Lilly .......... | 12 1-2 feet N. from the S. line of Lilly Street.<br>15 3-4 feet W. from the W. line of Sheridan St.. | 4 |
| Maple.. ....... | 18 1-2 feet S. from the N. line of Maple Street.<br>1 foot W. from the E. line of Chatham Street... | 6 |
| May ........... | 17 feet W. from the E. line of May street.<br>On the line of the S. line of Waterhill Street... | 4 |
| Marrianna ..... | 11 feet N. from the S. line of Marianna Street.<br>On the line of the W. line of Chatham Street... | 4 |

## TABLE VII.—Continued.

### SHOWING THE LOCATION AND SIZE OF GATES SET IN 1881.

| Street. | Location. | Size. |
|---|---|---|
| Murray........ | 16 feet W. from the E. line of Murray Street.<br>On the line of the S. line of Waterhill Street... | 4 |
| Nottingham.... | 16 1-2 feet W. from the E. line of Nottingham St.<br>On the line of the S. line of Maple Street...... | 4 |
| Nottingham.... | 16 1-2 feet W. from the E. line of Nottingham St.<br>On the line of the N. line of Western Ave...... | 4 |
| Nottingham.... | 16 feet W. from the E. line of Nottingham Street.<br>On the line of the S. line of Western Ave...... | 4 |
| Pendexter...... | 15 1-2 feet E. from the W. line of Pendexter St.<br>1 foot N. from the N. line of Boston Street..... | 6 |
| Pendexter...... | 17 feet E. from the W. line of Pendexter Street.<br>On the line of the S. line of Savory Street...... | 6 |
| Pine Grove ave. | 15 feet S. from the N. line of Pine Grove Ave.<br>On the line of the W. line of Tapley Street..... | 6 |
| Rockingham ... | 29 1-2 feet E. from the W. line of Rockingham St.<br>1 foot S. from the S. line of Western Ave...... | 6 |
| Robinson ...... | 27 1-2 feet W. from the E. line of Robinson Street<br>On the line of the S. line of Walnut Street...... | 6 |
| Robinson ...... | 19 feet W. from the E. line of Robinson Street.<br>2 feet N. from the N. line of Boston Street ..... | 6 |
| Sheridan....... | 32 feet W. from the E. line of Sheridan Street.<br>On the line of the S. line of Adams Street....... | 4 |
| Sewall......... | 25 1-2 feet N. from the S. line of Sewall Street.<br>On the line of the E. line of Jackson Street..... | 4 |
| Tapley ........ | 16 1-2 feet W. from the E. line of Tapley Street.<br>On the line of the S. line of Ontario Street...... | 6 |
| Woodman...... | 16 feet S. from the N. line of Woodman Street.<br>On the line of the E. line of Cottage Street..... | 6 |
| Waterhill...... | 20 1-2 feet N. from the S. line of Waterhill Street.<br>On the line of the W. line of Federal Street..... | 6 |
| Waterhill...... | 12 feet N. from the S. line of Waterhill Street.<br>On the line of the E. line of Cottage Street...... | 6 |
| Woodlawn ..... | 16 feet N. from the S. line of Woodlawn Street.<br>On the line of the E. line of Lovers Leap Ave... | 6 |

# TABLE VII.—Continued.

## LOCATION AND SIZE OF GATES SET IN COURTS.

| Court. | Location. | Size. |
|---|---|---|
| Alton | [illegible] feet E. from the W. line of Alton Street, on the line of the S. line of Wheeler Street..... | 1 1-4 |
| Buckley Place | [illegible] feet S. from the N. line of Buckley Place, on the line of the E. line of Prospect Street.... | 1 1-4 |
| Dennison Ave. | [illegible] feet W. from the E. line of Dennison Avenue, on the line of the N. line of Maple Street....... | 1 1-2 |
| Edwards | [illegible] feet E. from the W. line of Edwards Court, on the line of the S. line of Western Avenue ... | 2 |
| Ezra | [illegible] feet N. from the S. line of Ezra Street, on the line of the E. line of Mailey Street...... | 2 |
| Harbor | [illegible] feet W. from the E. line of Harbor-St Court, on the line of the S. line of Harbor Street ...... | 1 1-2 |
| Hilton | [illegible] feet N. from the S. line of Hilton Court, on the line of the W. line of Shepard Street.... | 2 |
| [illegible] | [illegible] W. [illegible] E. line of Jewett's Court, [illegible] S. line of Collins Street...... | 2 |
| Maple | [illegible] W. [illegible] E. line of Maple Court, [illegible] S. line of Maple Street....... | 1 1-2 |
| [illegible] | [illegible] N. [illegible] S. line of Marion Street, [illegible] E. line of Centre Street...... | 2 |
| [illegible] | [illegible] N. line of Neptune Street, [illegible] W. line of South Street ...... | 2 |
| [illegible] | [illegible] W. [illegible] E. line of Summer-St. Pl. [illegible] S. line of Summer Street..... | 1 1-4 |
| [illegible] | [illegible] N. line of Savory Court, [illegible] W. line of Pendexter Street.. | 2 |
| [illegible] | [illegible] W. [illegible] E. line of Lake St., at corner, [illegible] from the N. line of Lake Street. | 2 |

[illegible] 1881 ........................................ 54
[illegible] ........................................393

[illegible] to January 1, 1882 ........................447

## TABLE VIII.

### SHOWING THE NUMBER AND LOCATION OF HYDRANTS SET IN 1881.

| Street. | Location. |
|---|---|
| Adams | Corner Sheridan Street |
| Autumn | Corner Bloomfield Street |
| Astor | 250 feet S. from Summer Street |
| Boston | Corner Bacheller Street |
| Boston | Corner Wyoma Street |
| Boston | Corner Pendexter Street |
| Boston | Corner Jenness Street |
| Beacon Hill Avenue | 270 feet E. from Washington Street |
| Clough | 315 feet E. from Chatham Street |
| Douglas | 160 feet N. from Savory Street |
| Evelyn | 370 feet N. from Oakwood Avenue |
| Everett | 195 feet N. from Hancock Street |
| Everett | Corner Lovers Leap Avenue |
| Glenwood | 420 feet E. from Chatham Street |
| Jefferson | 420 feet E. from Rockaway Street |
| Jackson | 320 feet N. from Marrianna Street |
| Logan | 340 feet E. from Chestnut Street |
| Marrianna | 350 feet W. from Chatham Street |
| Michigan Avenue | 760 feet N. from Ocean Street |
| Michigan Avenue | Corner Superior Street |
| Maple | 375 feet E. from Chatham Street |
| Maple | 690 feet E. from Chatham Street |
| Maple | 1020 feet E. from Chatham Street |
| Murray | 400 feet S. from Waterhill Street |
| Murray | 800 feet S. from Waterhill Street |
| Nottingham | 420 feet S. from Western Avenue |
| Pendexter | Corner Otis Street |
| Pendexter | Corner Savory Street |
| Pine Grove Avenue | 200 feet W. from Tapley Street |
| Rockingham | 410 feet S. from Western Avenue |
| Robinson | 350 feet N. from Boston Street |
| Robinson | 720 feet N. from Boston Street |
| Robinson | 350 feet S. from Walnut Street |
| Roanoke | Corner Jenness Street |
| Sewall | 165 feet E. from Jackson Street |
| Tapley | Corner Woodlawn Street |
| Tapley | Corner Ontario Street |
| Woodman | 325 feet E. from Cottage Street |
| Woodman | 650 feet E. from Cottage Street |
| Waterhill | 310 feet W. from Federal Street |
| Waterhill | Corner Murray Street |
| Waterhill | Corner Abbott Street |

| | |
|---|---|
| Number of hydrants set in 1881 | 42 |
| Number of hydrants previously set | 411 |
| Number of hydrants set to January 1, 1881 | 453 |

## TABLE IX.

SHOWING THE NUMBER AND LENGTH OF SERVICES PUT IN IN 1881.

| Month. | Size and Length of Pipe. | | | | | | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 inch. | | 2 inch | | 1 1-2 inch | | 1 1-4 inch. | | 1 inch. | | 3-4 inch | | | |
| | No. | Length. | No. | Length. | No. | Length | No. | Length. | No. | Length. | No. | Length. | No. | Length. |
| January........ | .... | ........ | .... | .......... | .... | ........ | .... | ........ | 1 | 49.02 | 1 | 21.01 | 2 | 70.03 |
| February ...... | .... | ........ | .... | .......... | .... | ........ | .... | ........ | .... | ........ | .... | .......... | .... | ........ |
| March ......... | .... | ........ | .... | .......... | .... | ........ | .... | ........ | 1 | 95.08 | 17 | 690.02 | 18 | 785.10 |
| April ......... | .... | ........ | 1 | 23.08 | .... | ........ | .... | ........ | 2 | 287.03 | 32 | 920 | 35 | 1,230.11 |
| May ........... | .... | ........ | .... | .......... | .... | ........ | .... | ........ | 4 | 303.03 | 23 | 866.06 | 27 | 1,169.09 |
| June .......... | .... | ........ | .... | .......... | .... | ........ | .... | ........ | 5 | 1,406.01 | 16 | 647 | 21 | 2,053.01 |
| July .......... | .... | ........ | .. | .......... | .... | ........ | .... | ........ | 5 | 522.10 | 44 | 1,413.05 | 49 | 1,936.03 |
| August ........ | .... | ........ | .... | .......... | .... | ........ | .... | ........ | 4 | 305.08 | 47 | 1,519.09 | 51 | 1,825.05 |
| September ..... | .... | ........ | .... | .......... | .... | ........ | 1 | 23.09 | 7 | 290.10 | 44 | 1,638.08 | 52 | 1,953.03 |
| October........ | .... | ........ | ... | .......... | .... | ...... | 1 | 124.04 | 6 | 389.03 | 61 | 2,403.08 | 68 | 2,917.03 |
| November ...... | .... | ........ | .... | .......... | .... | ........ | .... | ........ | 11 | 628.03 | 60 | 2,270.04 | 71 | 2,898.07 |
| December ...... | 1 | 224.08 | .... | 222.04 | .... | ........ | .... | ........ | 5 | 331 | 59 | 2,430 | 65 | 3,208 |
| Totals ......... | 1 | 224.08 | 1 | 246 | | | 2 | 148.01 | 51 | 4,609.03 | 404 | 14,820.10 | 469 | 20,048.10 |

# TABLE X.

## REPAIRS OF PIPES HYDRANTS AND GATES FOR THE YEAR 1881.

| Month. | Size of Pipe. | | | | | | | | | | | Size of Gate. | | | | | | Hydrants. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 16 | 12 | 10 | 8 | 6 | 4 | 2 | 1½ | 1¼ | 1 | ¾ | 16 | 12 | 10 | 8 | 6 | 4 | |
| January | | | 2 | | 1 | | | | | 2 | | | | | | | | 1 |
| February | | | | | 5 | 2 | | | | 3 | | | | | | | | 1 |
| March | 1 | | | | 5 | 3 | | 1 | | 2 | | | | | | | | 8 |
| April | | | | 1 | 4 | 8 | | | 2 | 1 | 3 | | | | | | 3 | 4 |
| May | | | 1 | 1 | 3 | 4 | | | 1 | 1 | 2 | | | | | | | 4 |
| June | | | | 2 | 2 | 2 | | | 1 | | | | | | | | | 2 |
| July | | | 4 | | 11 | 3 | | | | | | | | | | | | 3 |
| August | | | | 1 | 3 | 1 | | | | 1 | 2 | | | | | 1 | | 1 |
| September | | | | 3 | 3 | 4 | | | | | | | | | | | | 1 |
| October | | | | | 5 | 4 | | | | | 1 | | | | | | | 2 |
| November | | | | 1 | 1 | 2 | | | | 1 | | | | | | | | 1 |
| December | | | | | 5 | 6 | | | | | 1 | | | | | | | 18 |
| Totals | 1 | | 7 | 9 | 48 | 39 | | 1 | 4 | 11 | 9 | | | | | 1 | 3 | 41 |

## METEOROLOGICAL RECORD FOR JANUARY, 1881.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.23 | 0°5 | 69 | 30.25 | 14°5 | 45 | 30.27 | 13° | 53 | 18°5 | 0°5 | 18° | 9°5 | .00 |
| 2 | 30.28 | 8.5 | 55 | 30.26 | 18.5 | 61 | 30.22 | 16.5 | 42 | 25 | 8 | 17 | 16.5 | .00 |
| 3 | 30.15 | 15.5 | 74 | 30.15 | 33.5 | 70 | 30.12 | 30 | 67 | 35 | 11 | 24 | 23 | .00 |
| 4 | 30.19 | 11 | 49 | 30.24 | 21.5 | 72 | 30.24 | 29 | 72 | 30 | 12 | 18 | 21 | .22 |
| 5 | 30.10 | 22 | 72 | 30.09 | 28 | 88 | 30.08 | 27 | 88 | 32.5 | 22 | 10.5 | 27.2 | .37 |
| 6 | 29.89 | 32 | 84 | 29.77 | 33 | 89 | 29.72 | 35 | 100 | 37 | 28 | 9 | 32.5 | .24 |
| 7 | 29.87 | 34.5 | 75 | 29.94 | 37.5 | 72 | 30.02 | 32 | 59 | 38 | 15.5 | 22.5 | 26.7 | .00 |
| 8 | 30.34 | 15.5 | 48 | 30.39 | 24 | 42 | 30.41 | 20.5 | 49 | 26.5 | 7.5 | 19 | 17 | .00 |
| 9 | 30.54 | 8 | 44 | 30.54 | 26 | 57 | 30.52 | 28 | 77 | 36 | 8 | 28 | 22 | 1.65 |
| 10 | 30.23 | 36 | 100 | 29.78 | 42 | 100 | 29.79 | 34 | 80 | 44 | 24 | 20 | 34 | 1.08 |
| 11 | 30.02 | 23 | 60 | 30.10 | 28.5 | 83 | 30.11 | 28 | 77 | 31 | 20.5 | 10.5 | 25.7 | .00 |
| 12 | 30.03 | 20.5 | 67 | 30.03 | 25 | 68 | 30.04 | 22 | 51 | 27 | 19 | 8 | 23 | .00 |
| 13 | 30.06 | 21 | 56 | 30.03 | 39 | 82 | 29.97 | 37 | 81 | 42 | 23 | 19 | 32.5 | .00 |
| 14 | 29.80 | 38 | 86 | 29.71 | 43 | 83 | 29.68 | 35 | 90 | 44 | 7 | 37 | 25.5 | .20 |
| 15 | 29.91 | 7 | 54 | 29.99 | 19 | 39 | 30.06 | 17 | 35 | 22 | 8 | 14 | 15 | .00 |
| 16 | 30.11 | 16.5 | 75 | 30.10 | 29.5 | 88 | 30.09 | 28 | 65 | 31.5 | 17.5 | 14 | 24.5 | .00 |
| 17 | 30.22 | 25 | 74 | 30.24 | 35 | 71 | 30.26 | 33 | 51 | 37 | 17 | 20 | 27 | .00 |
| 18 | 30.38 | 17.5 | 51 | 30.50 | 29 | 55 | 30.52 | 26.5 | 70 | 31 | 18 | 13 | 24.5 | .00 |
| 19 | 30.44 | 21 | 57 | 30.36 | 30 | 95 | 30.24 | 31.5 | 75 | 34 | 19.5 | 14.5 | 26.7 | .03 |
| 20 | 30.24 | 19.5 | 47 | 30.14 | 34 | 62 | 30.10 | 32 | 59 | 36.5 | 19.5 | 17 | 28 | .00 |
| 21 | [illegible] | [illegible] | 79 | 29.98 | 34.5 | 90 | 29.75 | 31 | 95 | 35 | 18.5 | 16.5 | 26.7 | 1.76 |
| 22 | 29.63 | 18.5 | 77 | 29.65 | 26 | 87 | 29.72 | 29 | 72 | 31 | 19 | 12 | 25 | .00 |
| 23 | 29.8[illegible] | 23 | 60 | 29.82 | 27.5 | 52 | 29.82 | 22.5 | 44 | 30 | 12 | 18 | 21 | .00 |
| 24 | 30.03 | [illegible] | 51 | 30.05 | 24 | 17 | 30.08 | 22 | 44 | 26 | 6 | 20 | 16 | .00 |
| 25 | 30.09 | 8 | 78 | 30.10 | 24 | 54 | 30.11 | 22.5 | 52 | 27.5 | 8 | 19.5 | 17.7 | .00 |
| 26 | 30.10 | 17.5 | 67 | 30.07 | 25 | 49 | 30.03 | 22.5 | 59 | 28 | 17.5 | 10.5 | 22.7 | .00 |
| 27 | 29.9[illegible] | 18.5 | 38 | 29.97 | 19 | 26 | 29.98 | 14 | 28 | 21 | 5 | 16 | 13 | .00 |
| 28 | 30.04 | [illegible] | 25 | 30.05 | 9.5 | 26 | 30.06 | 7.5 | 32 | 11.5 | 5 | 6.5 | 8.2 | .00 |
| 29 | 30.1[illegible] | [illegible] | 31 | 30.15 | 11 | 36 | 30.17 | 11.5 | 41 | 16 | 5.5 | 10.5 | 10.7 | .00 |
| 30 | 30.19 | [illegible] | 43 | 30.18 | 14.5 | 55 | 30.15 | 13.5 | 53 | 17.5 | 7.5 | 10 | 12.5 | .05 |
| 31 | 30.11 | 13 | 6[illegible] | 30.13 | 18 | 45 | 30.14 | 16 | 41 | 21 | 7 | 14 | 14 | .00 |

Monthly range ........................................43°5
Monthly mean ........................................ 21°45
Monthly rainfall .......................................... 5.60

## METEOROLOGICAL RECORD FOR FEBRUARY, 1881.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.20 | 8° | 55 | 30.18 | 15° | 39 | 30.13 | 13° | 35 | 18° | -4° | 22 | 7° | .00 |
| 2 | 30.08 | -4 | 48 | 30.06 | 4.5 | 35 | 30.04 | 3 | 32 | 6.5 | -4 | 10.5 | 1.2 | .00 |
| 3 | 30.00 | 1 | 56 | 29.99 | 15.5 | 48 | 29.98 | 15 | 47 | 17 | 1 | 16 | 9 | .00 |
| 4 | 30.04 | 13 | 81 | 30.05 | 23.5 | 47 | 30.07 | 19 | 54 | 24.5 | 13 | 11.5 | 18.7 | .00 |
| 5 | 30.19 | 20.5 | 49 | 30.22 | 29 | 66 | 30.24 | 27 | 76 | 31.5 | 20.5 | 11 | 26 | .00 |
| 6 | 30.47 | 21.5 | 50 | 30.56 | 29.5 | 51 | 30.63 | 30.5 | 52 | 33 | 18.5 | 14.5 | 25.7 | .00 |
| 7 | 30.73 | 20 | 78 | 30.75 | 33 | 54 | 30.75 | 31 | 68 | 35 | 20 | 15 | 27.5 | .00 |
| 8 | 30.71 | 25 | 56 | 30.69 | 38.5 | 72 | 30.65 | 36 | 71 | 41 | 25.5 | 15.5 | 33.2 | .00 |
| 9 | 30.53 | 34 | 90 | 30.49 | 43 | 83 | 30.42 | 41.5 | 83 | 47.5 | 34.5 | 13 | 41 | .00 |
| 10 | 30.25 | 43 | 91 | 30.17 | 48 | 88 | 30.07 | 45 | 92 | 50 | 39 | 11 | 44.5 | .15 |
| 11 | 30.03 | 39 | 91 | 30.09 | 48 | 66 | 30.14 | 43.5 | 55 | 48 | 35 | 13 | 41.5 | .00 |
| 12 | 30.15 | 38 | 81 | 30.02 | 37 | 90 | 29.66 | 38.5 | 100 | 47.5 | 37 | 10.5 | 42.2 | 1.52 |
| 13 | 29.30 | 36.5 | 71 | 29.38 | 35.5 | 85 | 29.56 | 33 | 51 | 36.5 | 19 | 17.5 | 27.7 | .06 |
| 14 | 29.85 | 19 | 53 | 29.96 | 24.5 | 37 | 30.07 | 23.5 | 47 | 26.5 | 15 | 11.5 | 20.7 | .00 |
| 15 | 30.56 | 17 | 67 | 30.46 | 29.5 | 61 | 30.09 | 31 | 57 | 31 | 18 | 13 | 24.5 | .17 |
| 16 | 30.38 | 32 | 89 | 30.09 | 35 | 75 | 29.99 | 35 | 80 | 36.5 | 26.5 | 10 | 31.5 | 26 |
| 17 | 30.24 | 28.5 | 50 | 30.28 | 32.5 | 55 | 30.30 | 30.5 | 68 | 35 | 21 | 14 | 28 | .00 |
| 18 | 30.48 | 23 | 73 | 30.45 | 33.5 | 61 | 30.34 | 33.5 | 84 | 39 | 23 | 16 | 31 | .72 |
| 19 | 29.88 | 36 | 90 | 29.85 | 37 | 81 | 29.95 | 32 | 49 | 38.5 | 19 | 19.5 | 28.7 | .03 |
| 20 | 30.37 | 21 | 79 | 30.44 | 32 | 69 | 30.43 | 30.5 | 57 | 32.5 | 21 | 11.5 | 26.7 | .01 |
| 21 | 30.25 | 32.5 | 95 | 30.09 | 34.5 | 90 | 29.99 | 32 | 89 | 35 | 26 | 9 | 30.5 | .58 |
| 22 | 30.14 | 26 | 75 | 30.07 | 36 | 54 | 30.12 | 34 | 62 | 38 | 27.5 | 10.5 | 32.7 | .00 |
| 23 | 29.93 | 34 | 85 | 29.77 | 44 | 71 | 29.73 | 31.5 | 74 | 44.5 | 2.5 | 42 | 23.5 | .01 |
| 24 | 29.97 | 2.5 | 45 | 30.04 | 8 | 33 | 30.10 | 9 | 33 | 14 | 2.5 | 11.5 | 8.2 | .06 |
| 25 | 30.19 | 11 | 59 | 30.17 | 17.5 | 60 | 30.17 | 18.5 | 24 | 20.5 | 5.5 | 15 | 13 | .03 |
| 26 | 30.36 | 10.5 | 58 | 30.39 | 22 | 44 | 30.38 | 26 | 76 | 35 | 11 | 24 | 23 | .00 |
| 27 | 30.24 | 33.5 | 84 | 30.15 | 42.5 | 66 | 30.07 | 39.5 | 77 | 46 | 33.5 | 12.5 | 39.7 | 1.03 |
| 28 | 29.79 | 41.5 | 100 | 29.64 | 46 | 92 | 29.58 | 44 | 92 | 48 | 36 | 12 | 42 | .18 |

| | |
|---|---|
| Monthly range | 58°0 |
| Monthly mean | 26°77 |
| Monthly rainfall | 4.75 |

## METEOROLOGICAL RECORD FOR MARCH, 1881.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.27 | 37°5 | 95 | 29.24 | 37° | 90 | 29.23 | 38° | 90 | 40° | 34°5 | 5°5 | 37°2 | .21 |
| 2 | 29.48 | 34.5 | 95 | 29.57 | 35.5 | 95 | 29.69 | 35 | 90 | 36.5 | 33.5 | 3 | 35 | .09 |
| 3 | 29.94 | 36 | 76 | 29.96 | 35.5 | 90 | 29.96 | 34.5 | 89 | 36.5 | 34 | 2.5 | 35.2 | .83 |
| 4 | 29.88 | 34.5 | 95 | 29.72 | 35.5 | 90 | 29.56 | 37 | 100 | 39 | 32 | 7 | 35.5 | .97 |
| 5 | 29.49 | 32 | 84 | 29.54 | 38.5 | 68 | 29.53 | 35 | 62 | 40.5 | 31 | 9.5 | 35.7 | .00 |
| 6 | 29.55 | 31 | 68 | 29.56 | 38.5 | 68 | 29.59 | 39 | 77 | 41 | 30 | 11 | 35.5 | .00 |
| 7 | 29.81 | 32 | 64 | 29.87 | 45.5 | 54 | 29.91 | 43.5 | 40 | 47.5 | 32 | 15.5 | 39.7 | .00 |
| 8 | 30.01 | 35 | 62 | 30.07 | 44.5 | 53 | 30.07 | 40 | 73 | 45.5 | 33.5 | 12 | 39.5 | .00 |
| 9 | 30.05 | 36 | 100 | 30.03 | 40 | 95 | 29.94 | 38.5 | 95 | 40.5 | 37 | 3.5 | 38.7 | 3.81 |
| 10 | 29.66 | 38.5 | 100 | 29.60 | 39 | 100 | 29.54 | 37 | 100 | 39.5 | 32.5 | 7 | 36 | .49 |
| 11 | 29.44 | 32.5 | 79 | 29.43 | 31.5 | 89 | 29.44 | 27 | 76 | 33 | 27 | 6 | 30 | .02 |
| 12 | 29.69 | 31 | 73 | 29.79 | 43 | 83 | 29.84 | 38 | 68 | 44.5 | 32.5 | 12 | 38.5 | .18 |
| 13 | 29.75 | 34 | 80 | 29.77 | 38 | 68 | 29.78 | 36.5 | 76 | 39.5 | 34 | 5.5 | 36.7 | .03 |
| 14 | 29.85 | 35 | 90 | 29.95 | 37 | 76 | 30.03 | 36 | 81 | 39.5 | 29 | 10.5 | 34.2 | .01 |
| 15 | 30.27 | 32 | 84 | 30.33 | 37 | 67 | 30.32 | 35.5 | 76 | 38.5 | 31.5 | 7 | 35 | .00 |
| 16 | 30.19 | 35 | 76 | 30.04 | 45.5 | 65 | 30.00 | 45 | 68 | 50 | 35 | 15 | 42.5 | .00 |
| 17 | 30.17 | 36 | 85 | 30.21 | 36.5 | 71 | 30.20 | 35 | 80 | 37.5 | 34.5 | 3 | 36 | .00 |
| 18 | 30.21 | 35.5 | 80 | 30.23 | 39.5 | 68 | 30.23 | 37 | 81 | 40 | 36.5 | 3.5 | 38.2 | .00 |
| 19 | 30.23 | 37.5 | 81 | 30.21 | 38 | 81 | 30.15 | 36.5 | 76 | 40.5 | 34.5 | 6 | 37.5 | .75 |
| 20 | 29.84 | 35.5 | 76 | 29.71 | 37.5 | 85 | 29.59 | 38.5 | 90 | 40 | 35.5 | 4.5 | 37.7 | .16 |
| 21 | 29.52 | 39.5 | 82 | 29.54 | 48 | 62 | 29.54 | 45 | 60 | 49 | 33.5 | 15.5 | 41.2 | .00 |
| 22 | 29.52 | 36.5 | 76 | 29.50 | 45 | 53 | 29.47 | 40 | 52 | 47 | 31.5 | 15.5 | 39.2 | .00 |
| 23 | 29.44 | 33.5 | 70 | 29.43 | 39 | 64 | 29.41 | 37 | 47 | 39.5 | 30 | 9.5 | 34.7 | .01 |
| 24 | 29.45 | 32 | 75 | 29.45 | 38.5 | 51 | 29.45 | 38 | 47 | 40 | 31 | 9 | 35.5 | .00 |
| 25 | 29.57 | 34 | 62 | 29.59 | 41 | 45 | 29.59 | 38 | 51 | 41.5 | 30 | 11.5 | 35.7 | .00 |
| 26 | 29.64 | 32.5 | 59 | 29.59 | 34 | 52 | 29.50 | 32 | 49 | 36 | 25 | 11 | 30.5 | .00 |
| 27 | 29.42 | 24.5 | 68 | 29.40 | 31.5 | 58 | 29.38 | 32.5 | 55 | 34.5 | 25 | 9.5 | 29.7 | .00 |
| 28 | 29.41 | 31.5 | 48 | 29.43 | 36.5 | 43 | 29.46 | 40 | 38 | 42 | 30 | 12 | 36 | .00 |
| 29 | 29.67 | 33 | 66 | 29.71 | 44 | 44 | 29.73 | 45 | 44 | 48.5 | 34 | 14.5 | 41.2 | .00 |
| 30 | 29.74 | 36 | 63 | 29.64 | 35.5 | 76 | 29.40 | 33 | 100 | 37.5 | 33 | 4.5 | 35.2 | .84 |
| 31 | 29.09 | 34.5 | 100 | 29.07 | 37.7 | 100 | 29.12 | 33 | 90 | 39.5 | 32.5 | 7 | 36 | .02 |

Monthly range.................................. 25°
Monthly mean.................................. 36°45
Monthly rainfall.................................. 8.42

## METEOROLOGICAL RECORD FOR APRIL, 1881.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.33 | 37°5 | 76 | 29.38 | 45° | 53 | 29.38 | 48° | 49 | 49° | 32°5 | 16°5 | 40°7 | .00 |
| 2 | 29.40 | 34.5 | 62 | 29.46 | 38 | 59 | 29.52 | 34.5 | 40 | 41 | 26 | 15 | 33.5 | .00 |
| 3 | 29.62 | 27.5 | 42 | 29.61 | 34 | 62 | 29.59 | 36 | 46 | 37.5 | 25 | 12.5 | 31.2 | .00 |
| 4 | 29.60 | 27 | 52 | 29.57 | 36 | 46 | 29.51 | 35 | 45 | 36.5 | 23 | 13.5 | 29.7 | .00 |
| 5 | 29.43 | 23 | 66 | 29.41 | 29 | 55 | 29.40 | 26.5 | 63 | 31 | 20 | 11 | 25.5 | .02 |
| 6 | 29.49 | 22 | 66 | 29.50 | 27 | 64 | 29.51 | 26 | 63 | 32.5 | 22.5 | 10 | 27.5 | .00 |
| 7 | 29.67 | 31.5 | 68 | 29.68 | 45.5 | 57 | 29.75 | 44 | 52 | 47.5 | 32.5 | 15 | 40 | .00 |
| 8 | 29.83 | 39 | 64 | 29.82 | 49.5 | 47 | 29.81 | 47.5 | 48 | 51.5 | 32.5 | 19 | 42 | .00 |
| 9 | 29.84 | 40 | 52 | 29.85 | 45 | 49 | 29.85 | 41 | 66 | 49 | 34 | 15 | 41.5 | .00 |
| 10 | 29.88 | 42.5 | 62 | 29.89 | 45.5 | 57 | 29.88 | 47 | 62 | 47 | 34 | 13 | 40.5 | .00 |
| 11 | 29.87 | 42.5 | 54 | 29.87 | 51 | 52 | 29.87 | 48.5 | 49 | 59 | 37 | 22 | 48 | .00 |
| 12 | 29.97 | 41.5 | 57 | 29.97 | 36 | 85 | 29.93 | 35 | 90 | 41.5 | 35 | 6.5 | 38.2 | .22 |
| 13 | 29.91 | 37 | 85 | 29.87 | 37 | 95 | 29.76 | 36 | 100 | 38.5 | 34.5 | 4 | 36.5 | .39 |
| 14 | 29.73 | 36.5 | 85 | 29.75 | 40 | 82 | 29.74 | 40 | 74 | 41.5 | 32 | 9.5 | 36.7 | .35 |
| 15 | 29.31 | 32 | 100 | 29.27 | 37.5 | 86 | 29.31 | 38.5 | 64 | 40 | 32 | 8 | 36 | .05 |
| 16 | 29.46 | 40 | 65 | 29.51 | 52 | 41 | 29.54 | 51.5 | 34 | 56 | 39.5 | 16.5 | 47.7 | .00 |
| 17 | 29.66 | 46.5 | 24 | 29.66 | 50 | 23 | 29.69 | 50.5 | 24 | 52.5 | 37 | 15.5 | 44.7 | .00 |
| 18 | 29.78 | 41.5 | 42 | 29.79 | 50 | 23 | 29.79 | 48.5 | 27 | 51.5 | 34 | 17.5 | 42.7 | .00 |
| 19 | 29.97 | 38 | 47 | 30.01 | 47.5 | 32 | 30.03 | 48.5 | 29 | 50.5 | 37 | 13.5 | 43.7 | .00 |
| 20 | 30.13 | 40 | 52 | 30.15 | 42.5 | 58 | 30.13 | 43 | 64 | 47.5 | 36 | 11.5 | 41.7 | .00 |
| 21 | 30.06 | 45 | 60 | 30.04 | 59 | 27 | 30.02 | 59 | 25 | 61 | 38 | 23 | 49.5 | .00 |
| 22 | 30.10 | 40 | 77 | 30.14 | 43 | 75 | 30.12 | 43 | 87 | 45 | 38 | 7 | 41.5 | .00 |
| 23 | 30.14 | 43.5 | 78 | 30.19 | 48.5 | 60 | 30.21 | 44 | 68 | 54 | 43 | 11 | 48.5 | .00 |
| 24 | 30.17 | 53.5 | 58 | 30.00 | 71.5 | 77 | 29.86 | 75.5 | 36 | 77 | 53 | 24 | 65 | .00 |
| 25 | 29.98 | 54.5 | 92 | 30.04 | 50 | 51 | 30.04 | 48 | 62 | 55 | 43 | 12 | 49 | .00 |
| 26 | 29.99 | 46.5 | 76 | 29.89 | 54 | 86 | 29.79 | 59.5 | 82 | 62 | 47.5 | 14.5 | 54.7 | .02 |
| 27 | 29.94 | 50.5 | 86 | 29.97 | 48.5 | 88 | 29.94 | 46 | 92 | 52 | 44 | 8 | 48 | .01 |
| 28 | 29.91 | 52 | 83 | 29.92 | 68 | 53 | 29.94 | 67 | 31 | 69 | 48 | 21 | 58.5 | .13 |
| 29 | 29.99 | 48 | 88 | 29.93 | 52.5 | 89 | 29.91 | 59 | 33 | 60.5 | 39.5 | 21 | 50 | .11 |
| 30 | 30.11 | 44 | 55 | 30.15 | 52.5 | 41 | 30.17 | 48.5 | 46 | 54.5 | 36.5 | 18 | 45.5 | .00 |

| | | | |
|---|---|---|---|
| Monthly range | 57° | | |
| Monthly mean | | 42°62 | |
| Monthly rainfall | | | 1 30 |

## METEOROLOGICAL RECORD FOR MAY, 1881.

| | 8 A. M. | | | 2 P. M. | | | 9 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | [illegible] | 44 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 47 | 55 | 45 | 10 | 50 | .02 |
| 2 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 51 | 63.5 | 39 | 24.5 | 51.2 | .02 |
| 3 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 47 | [illegible] | 48.5 | 35.5 | 13 | 42 | .00 |
| 4 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 45 | 79 | 50.5 | 36.5 | 14 | 43.5 | .00 |
| 5 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 53 | 56 | 58 | 46.5 | 11.5 | 52.2 | .05 |
| 6 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 96 | 47 | 42.0 | 5 | 44.5 | .38 |
| 7 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 88 | 58 | 47 | 11 | 52.5 | .00 |
| 8 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 88 | 68.5 | 44 | 24.5 | 56.2 | .00 |
| 9 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 64 | 69 | 49 | 20 | 59 | .00 |
| 10 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 86 | 71 | 48 | 23 | 59.5 | .00 |
| 11 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 69 | 75 | 53 | 22 | 64 | .00 |
| 12 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 49 | 96 | 71 | 48.5 | 22.5 | 59.7 | .00 |
| 13 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 60.5 | 46.5 | 14 | 53.5 | .00 |
| 14 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 62.5 | 52.5 | 10 | 57.5 | .35 |
| 15 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 45.5 | 14.5 | 52.7 | .21 |
| 16 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 46 | 42 | 4 | 44 | .19 |
| 17 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 44.5 | 41 | 3.5 | 42.7 | .34 |
| 18 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 45.5 | 42 | 3.5 | 43.7 | .50 |
| 19 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 48.5 | 45 | 3.5 | 46.7 | .20 |
| 20 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 59.5 | 44 | 15.5 | 51.7 | .00 |
| 21 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 88 | 57 | 47 | 10 | 52 | .00 |
| 22 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 84 | 62 | 52.5 | 9.5 | 57.7 | .00 |
| 23 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 63 | 51.5 | 11.5 | 57.2 | .00 |
| 24 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 84 | 61 | 50.5 | 10.5 | 55.7 | .00 |
| 25 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 92 | 66 | 45 | 21 | 55.5 | .00 |
| 26 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 69 | 48.5 | 20.5 | 58.7 | .00 |
| 27 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 72 | 86.5 | 60 | 26.5 | 73.2 | .00 |
| 28 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 71 | 66.5 | 59 | 7.5 | 62.7 | .03 |
| 29 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 77 | 72 | 59 | 13 | 65.5 | .02 |
| 30 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 86 | 62.5 | 23.5 | 74.2 | .74 |
| 31 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 73 | 60 | 13 | 66.5 | .00 |

M[illegible] ........................................ [illegible]
Monthly mean ........................................ 55.03
M[illegible] ........................................ 3.14

## METEOROLOGICAL RECORD FOR JUNE, 1881.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A.M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.82 | 66° | 63 | 29.83 | 67° | 53 | 29.82 | 58°5 | 70 | 69°5 | 53°5 | 16° | 61°5 | .10 |
| 2 | 29.83 | 56 | 84 | 29.87 | 61.5 | 66 | 29.89 | 53 | 93 | 62.5 | 47.5 | 15 | 55 | .01 |
| 3 | 29.93 | 48.5 | 96 | 29.89 | 49.5 | 89 | 29.81 | 48 | 71 | 50 | 44.5 | 5.5 | 47.2 | .52 |
| 4 | 29.67 | 45.5 | 100 | 29.69 | 51.5 | 79 | 29.72 | 54.5 | 77 | 58 | 45.5 | 12.5 | 51.7 | .18 |
| 5 | 29.78 | 56 | 81 | 29.73 | 71.5 | 25 | 29.72 | 67 | 53 | 71.5 | 47.5 | 24 | 59.5 | .23 |
| 6 | 29.90 | 52.5 | 66 | 29.95 | 59 | 65 | 29.99 | 61.5 | 38 | 63.5 | 43.5 | 20 | 53.5 | .00 |
| 7 | 30.22 | 54 | 52 | 30.22 | 57 | 75 | 30.15 | 58.5 | 70 | 62 | 51 | 11 | 56.5 | .11 |
| 8 | 29.91 | 52 | 100 | 29.88 | 54.5 | 90 | 29.85 | 60 | 85 | 62 | 52 | 10 | 57 | .02 |
| 9 | 29.97 | 62 | 83 | 30.07 | 56 | 65 | 30.11 | 53.5 | 70 | 64 | 49 | 15 | 56.5 | .33 |
| 10 | 30.11 | 50.5 | 96 | 30.05 | 46.5 | 100 | 30.00 | 44.5 | 100 | 50.5 | 44 | 6.5 | 47.2 | 2.48 |
| 11 | 29.97 | 47.5 | 100 | 30.03 | 51 | 93 | 30.04 | 57.5 | 82 | 64 | 48 | 16 | 56 | .03 |
| 12 | 30.19 | 62 | 80 | 30.21 | 62.5 | 77 | 30.22 | 57 | 78 | 64 | 47 | 17 | 55.5 | .00 |
| 13 | 30.20 | 49 | 93 | 30.19 | 54.5 | 81 | 30.10 | 55 | 87 | 61 | 48.5 | 12.5 | 54.7 | .02 |
| 14 | 29.91 | 61 | 91 | 29.86 | 66 | 81 | 29.84 | 63.5 | 86 | 71 | 59 | 12 | 65 | .04 |
| 15 | 29.85 | 66 | 68 | 29.86 | 74 | 43 | 29.91 | 71.5 | 40 | 73.5 | 48 | 25.5 | 60.7 | .00 |
| 16 | 30.05 | 55 | 37 | 30.02 | 62 | 29 | 29.95 | 67 | 33 | 67.5 | 49 | 18.5 | 58.2 | .00 |
| 17 | 29.88 | 59.5 | 54 | 29.79 | 69.5 | 45 | 29.74 | 70.5 | 57 | 72.5 | 60 | 12.5 | 66.2 | .00 |
| 18 | 29.70 | 64.5 | 53 | 29.70 | 73 | 50 | 29.73 | 72 | 60 | 73 | 61 | 12 | 67 | .00 |
| 19 | 29.75 | 63.5 | 78 | 29.68 | 79.5 | 57 | 29.71 | 79.5 | 47 | 80.5 | 58 | 22.5 | 69.2 | .00 |
| 20 | 29.85 | 67.5 | 72 | 29.85 | 77 | 58 | 29.78 | 69 | 75 | 76.5 | 61.5 | 15 | 69 | .09 |
| 21 | 29.70 | 64 | 75 | 29.68 | 64 | 63 | 29.70 | 64 | 73 | 66 | 46.5 | 19.5 | 56.2 | .01 |
| 22 | 29.84 | 55 | 65 | 29.87 | 64 | 51 | 29.89 | 64.5 | 53 | 66 | 49 | 17 | 57.5 | .00 |
| 23 | 29.99 | 57.5 | 66 | 29.99 | 63.5 | 62 | 30.01 | 60 | 76 | 66 | 52 | 14 | 59 | .00 |
| 24 | 30.07 | 58 | 70 | 30.09 | 65 | 63 | 30.10 | 64 | 67 | 67.5 | 55 | 12.5 | 61.2 | .00 |
| 25 | 30.12 | 65 | 68 | 30.11 | 73.5 | 51 | 30.11 | 69.5 | 63 | 74.5 | 60.5 | 14 | 67.5 | .15 |
| 26 | 30.17 | 60.5 | 88 | 30.09 | 63.5 | 83 | 30.19 | 60.5 | 88 | 68.5 | 55 | 13.5 | 61.7 | .35 |
| 27 | 30.19 | 57.5 | 97 | 30.19 | 63.5 | 83 | 30.09 | 60.5 | 91 | 67.5 | 57.5 | 10 | 62.5 | .47 |
| 28 | 29.79 | 67.5 | 92 | 29.75 | 79 | 65 | 29.66 | 75.5 | 68 | 82 | 62.5 | 19.5 | 72.2 | .20 |
| 29 | 29.60 | 68.5 | 67 | 29.61 | 78.5 | 49 | 29.63 | 78 | 57 | 79 | 63.5 | 15.5 | 71.2 | .59 |
| 30 | 29.69 | 68.5 | 72 | 29.70 | 76.5 | 51 | 29.76 | 68 | 84 | 77.5 | 58.5 | 19 | 68 | .29 |

**Monthly range**.............................. 38°5

**Monthly mean**.............................. 60°16

**Monthly rainfall**..... ........................ 6.22

## METEOROLOGICAL RECORD FOR JULY, 1881.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.94 | 66 | 73 | 29.96 | 71.5 | 62 | 29.99 | 63°5 | 83 | 72°5 | 55° | 17°5 | 63°7 | .28 |
| 2 | 30.18 | 64 | 62 | 30.17 | 72 | 58 | 30.13 | 74.5 | 59 | 74.5 | 62.5 | 12 | 68.5 | .00 |
| 3 | 30.07 | 65 | 78 | 30.01 | 80 | 53 | 29.97 | 78 | 63 | 81 | 64.5 | 16.5 | 72.7 | .00 |
| 4 | 29.92 | 74 | 59 | 29.93 | 68.5 | 82 | 29.88 | 72 | 60 | 75.5 | 62 | 13.5 | 68.7 | .13 |
| 5 | 29.93 | 67 | 74 | 29.93 | 67 | 76 | 29.89 | 64.5 | 83 | 72.5 | 62.5 | 10 | 67.5 | .00 |
| 6 | 29.78 | 72.5 | 83 | 29.83 | 76.5 | 73 | 29.88 | 68 | 79 | 78.5 | 60.5 | 18 | 69.5 | .00 |
| 7 | 30.02 | 70 | 77 | 30.05 | 79 | 62 | 30.05 | 71 | 75 | 79.5 | 65 | 14.5 | 72.2 | .29 |
| 8 | 30.05 | 65 | 92 | 30.07 | 72 | 67 | 30.07 | 69.5 | 77 | 72 | 62 | 10 | 67 | .04 |
| 9 | 30.14 | 70 | 59 | 30.14 | 72 | 78 | 30.12 | 77 | 69 | 76 | 62.5 | 13.5 | 69.2 | .00 |
| 10 | 30.12 | 69 | 75 | 30.10 | 81.5 | 72 | 30.07 | 80 | 74 | 83.5 | 62 | 21.5 | 72.7 | .00 |
| 11 | 30.00 | 77 | 82 | 30.07 | 65 | 68 | 30.07 | 62 | 80 | 79 | 61 | 18 | 70 | .37 |
| 12 | 30.08 | 66 | 84 | 30.08 | 67 | 79 | 30.00 | 67 | 74 | 69.5 | 62.5 | 7 | 66 | .00 |
| 13 | 29.94 | 68 | 92 | 29.88 | 79 | 78 | 29.77 | 83 | 77 | 85 | 67.5 | 17.5 | 76.2 | .00 |
| 14 | 29.97 | 74 | 68 | 29.95 | 77.5 | 52 | 30.00 | 72 | 62 | 79.5 | 59.5 | 20 | 69.5 | .00 |
| 15 | 30.15 | 68 | 58 | 30.17 | 71.5 | 55 | 30.13 | 69 | 63 | 76.5 | 61 | 15.5 | 68.7 | .00 |
| 16 | 30.03 | 69.5 | 82 | 29.91 | 82 | 59 | 29.77 | 73 | 81 | 82.5 | 64.5 | 18 | 73.5 | .00 |
| 17 | 29.66 | 70.5 | 75 | 29.62 | 77 | 55 | 29.63 | 70 | 51 | 77.5 | 53.5 | 24 | 65.5 | .00 |
| 18 | 29.60 | 62 | 65 | 29.57 | 68 | 51 | 29.54 | 62 | 83 | 69 | 53.5 | 15.5 | 61.2 | .04 |
| 19 | 29.67 | 67 | 77 | 29.64 | 71.5 | 58 | 29.69 | 69 | 70 | 73 | 57.5 | 15.5 | 65.2 | .00 |
| 20 | 29.82 | 68 | 72 | 29.82 | 76 | 64 | 29.75 | 76 | 64 | 78.5 | 57.5 | 21 | 68 | .14 |
| 21 | 29.64 | 65 | 92 | 29.74 | 68 | 89 | 29.64 | 71 | 75 | 75 | 60 | 15 | 67.5 | .36 |
| 22 | 29.68 | 67 | 74 | 29.68 | 70 | 65 | [illegible] | 69.5 | 70 | 73 | 63.5 | 9.5 | 68.2 | .00 |
| 23 | 29.72 | 65.5 | 76 | 29.76 | 66 | 78 | 29.78 | 65 | 81 | 67.5 | 58 | 9.5 | 62.7 | .00 |
| 24 | [illegible] | 66.5 | 79 | 29.92 | 77 | 61 | 29.93 | 73 | 70 | 76.5 | 63.5 | 13 | 70 | .00 |
| 25 | [illegible] | 68.5 | 87 | 29.90 | [illegible] | 70 | 29.96 | 73.5 | 79 | 79.5 | 64.5 | 15 | 72 | .51 |
| 26 | [illegible] | 66 | 81 | [illegible] | [illegible] | [illegible] | 29.83 | 72.5 | 85 | 74 | 62.5 | 11.5 | 68.2 | .59 |
| 27 | 29.87 | [illegible] | 81 | 29.87 | [illegible] | 75 | 29.84 | 70.5 | 61 | 74 | 64.5 | 9.5 | 69.2 | .00 |
| 28 | 29.87 | 63.5 | 92 | [illegible] | 72 | 80 | 29.92 | 63.5 | 94 | 71.5 | 58.5 | 13 | 65 | .01 |
| 29 | [illegible] | [illegible] | 97 | [illegible] | [illegible] | 84 | 30.24 | 63 | 91 | 67 | 60 | 7 | 63.5 | .01 |
| 30 | [illegible] | [illegible] | 97 | [illegible] | 64 | 80 | 30.35 | 63 | 88 | 64 | 60.5 | 3.5 | 62.2 | .02 |
| 31 | [illegible] | 62.5 | 97 | [illegible] | 68.5 | 84 | 30.20 | 66.5 | 81 | 71 | 62.5 | 8.5 | 66.7 | .34 |

| | | | |
|---|---|---|---|
| Monthly range | 31°5 | | |
| Monthly mean | | 68°11 | |
| Monthly rainfall | | | 3.13 |

## METEOROLOGICAL RECORD FOR AUGUST, 1881.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.21 | 69° | 95 | 30.18 | 79° | 76 | 30.16 | 77° | 80 | 82° | 67° | 15° | 74°5 | .00 |
| 2 | 30.19 | 74 | 81 | 30.19 | 80.5 | 74 | 30.11 | 72.5 | 83 | 80.5 | 64.5 | 16 | 72.5 | .02 |
| 3 | 30.13 | 69.5 | 90 | 30.10 | 71.5 | 88 | 30.09 | 69 | 89 | 74 | 63.5 | 10.5 | 68.7 | .00 |
| 4 | 30.11 | 69.5 | 92 | 30.10 | 74.5 | 81 | 30.05 | 75 | 81 | 75 | 69.5 | 5.5 | 72.2 | .00 |
| 5 | 30.05 | 75 | 81 | 30.06 | 85.5 | 68 | 30.03 | 80 | 78 | 86.5 | 70 | 16.5 | 78.2 | .00 |
| 6 | 30.04 | 76 | 81 | 30.02 | 80.5 | 78 | 29.96 | 77.5 | 82 | 82.5 | 70.5 | 12 | 76.5 | .00 |
| 7 | 29.95 | 73.5 | 88 | 29.90 | 75.5 | 75 | 29.88 | 72.5 | 83 | 75.5 | 62 | 13.5 | 68.7 | .19 |
| 8 | 29.93 | 64 | 86 | 29.95 | 67.5 | 72 | 29.95 | 72 | 67 | 73 | 57.5 | 15.5 | 65.2 | .00 |
| 9 | 29.98 | 64 | 78 | 29.91 | 77.5 | 52 | 29.82 | 74 | 66 | 78 | 64 | 14 | 71 | .04 |
| 10 | 29.64 | 73.5 | 79 | 29.63 | 82.5 | 52 | 29.66 | 76 | 56 | 83 | 57.5 | 25.5 | 70.2 | .00 |
| 11 | 29.86 | 63 | 69 | 29.89 | 73 | 53 | 29.89 | 75.5 | 50 | 77 | 58.5 | 18.5 | 67.7 | .00 |
| 12 | 29.93 | 68 | 74 | 29.90 | 80.5 | 44 | 29.86 | 78 | 57 | 81.5 | 66.5 | 15 | 74 | .00 |
| 13 | 29.71 | 74 | 77 | 29.62 | 85.5 | 66 | 29.64 | 82.5 | 52 | 87 | 65 | 22 | 76 | .00 |
| 14 | 29.72 | 70.5 | 71 | 29.73 | 77.5 | 57 | 29.78 | 74 | 68 | 78 | 60 | 18 | 69 | .14 |
| 15 | 29.96 | 63.5 | 72 | 29.99 | 66 | 71 | 30.02 | 66.5 | 64 | 68.5 | 58.5 | 10 | 63.5 | .00 |
| 16 | 30.15 | 60.5 | 79 | 30.22 | 62 | 77 | 30.21 | 60 | 76 | 63 | 54 | 9 | 58.5 | .00 |
| 17 | 30.20 | 54 | 86 | 30.19 | 59 | 87 | 30.18 | 60 | 83 | 60.5 | 52.5 | 8 | 56.5 | .07 |
| 18 | 30.11 | 52.5 | 96 | 30.13 | 61 | 88 | 30.08 | 58.5 | 90 | 63.5 | 57 | 6.5 | 60.2 | .09 |
| 19 | 29.93 | 61.5 | 100 | 29.91 | 63 | 94 | 29.90 | 62.5 | 97 | 65.5 | 58.5 | 7 | 62 | .03 |
| 20 | 29.85 | 61 | 97 | 29.84 | 69 | 82 | 29.77 | 69 | 84 | 71.5 | 59 | 12.5 | 65.2 | .00 |
| 21 | 29.75 | 62.5 | 97 | 29.74 | 72.5 | 78 | 29.73 | 66.5 | 92 | 74 | 62 | 12 | 68 | .02 |
| 22 | 29.79 | 67.5 | 79 | 29.83 | 76 | 56 | 29.86 | 76 | 60 | 78 | 59 | 19 | 68.5 | .00 |
| 23 | 29.99 | 65 | 78 | 30.03 | 74 | 63 | 30.07 | 70 | 79 | 75 | 60 | 15 | 67.5 | .01 |
| 24 | 30.23 | 62 | 86 | 30.30 | 60.5 | 88 | 30.31 | 58.5 | 84 | 62 | 55 | 7 | 58.5 | .00 |
| 25 | 30.33 | 62 | 74 | 30.33 | 65 | 78 | 30.29 | 65 | 81 | 68 | 56 | 12 | 62 | .00 |
| 26 | 30.29 | 63 | 94 | 30.28 | 74.5 | 72 | 30.25 | 71 | 83 | 75 | 63 | 12 | 69 | .00 |
| 27 | 30.26 | 66 | 94 | 30.25 | 77 | 71 | 30.20 | 74 | 68 | 7 | 64 | 13 | 70.5 | .00 |
| 28 | 30.18 | 69.5 | 87 | 30.18 | 77 | 62 | 30.17 | 73.5 | 70 | 79 | 63.5 | 15.5 | 71.2 | .00 |
| 29 | 30.23 | 68.5 | 74 | 30.26 | 74.5 | 59 | 30.26 | 65.5 | 81 | 4 | 60.5 | 13.5 | 67.2 | .00 |
| 30 | 30.29 | 69 | 82 | 30.25 | 82.5 | 63 | 30.22 | 78 | 75 | 83 | 65.5 | 17.5 | 74.2 | .00 |
| 31 | 30.16 | 71 | 80 | 30.11 | 86.5 | 62 | 30.05 | 82 | 72 | 89.5 | | 18.5 | 80.2 | .00 |

| | | | |
|---|---|---|---|
| Monthly range | 37° | | |
| Monthly mean | | 68°64 | |
| Monthly rainfall | | | .61 |

## METEOROLOGICAL RECORD FOR SEPTEMBER, 1881.

| Date. | 8 A. M. Barometer. | 8 A. M. Thermometer. | 8 A. M. Humidity. | 2 P. M. Barometer. | 2 P. M. Thermometer. | 2 P. M. Humidity. | 9 P. M. Barometer. | 9 P. M. Thermometer. | 9 P. M. Humidity. | 24 hours ending 8 A. M. Maximum Thermometer. | 24 hours ending 8 A. M. Minimum Thermometer. | 24 hours ending 8 A. M. Daily range. | 24 hours ending 8 A. M. Daily mean. | 24 hours ending 8 A. M. Rainfall. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 88 | [illegible] | [illegible] | 82 | 65 | 92 | 63.5 | 28.5 | 77.7 | .00 |
| [illegible] | [illegible] | [illegible] | 88 | [illegible] | [illegible] | 94 | [illegible] | 61 | 100 | 64 | 58.5 | 5.5 | 61.2 | 1.30 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 88 | [illegible] | 60 | 91 | 63.5 | 58.5 | 5 | 61 | .05 |
| 4 | [illegible] | [illegible] | 94 | [illegible] | [illegible] | [illegible] | [illegible] | 61 | 80 | 64.5 | 59.5 | 5 | 62 | .01 |
| [illegible] | [illegible] | [illegible] | 94 | [illegible] | [illegible] | [illegible] | [illegible] | 66 | 94 | 70 | 62 | 8 | 66 | .01 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 92 | [illegible] | 74.5 | 83 | 75.5 | 68 | 7.5 | 71.7 | .00 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 49 | [illegible] | 86 | 65 | 92.5 | 67 | 25.5 | 79.7 | .00 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 63.5 | 64 | 68.5 | 59 | 9.5 | 63.7 | .00 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 71 | [illegible] | 73.5 | 62.5 | 11 | 68 | .02 |
| [illegible] | [illegible] | [illegible] | 88 | [illegible] | [illegible] | 88 | [illegible] | 59.5 | 94 | 69 | 58 | 11 | 63.5 | .11 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 64 | 94 | [illegible] | 62.5 | 94 | 65.5 | 60 | 5.5 | 62.7 | .07 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 62 | 88 | 65.5 | 53 | 12.5 | 59.2 | .08 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 84 | 72 | 53 | 19 | 62.5 | .01 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 57.5 | 7 | 61 | .00 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 57.5 | 7 | 59 | .00 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 64 | [illegible] | 11 | 58.5 | .00 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 12 | 55 | .00 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 82 | [illegible] | 54.5 | 11 | 60 | .00 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 57.5 | 12.5 | 63.7 | .00 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 77 | 75 | 48.5 | 26.5 | 61.7 | .00 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 62 | 53 | 9 | 57.5 | .00 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 9.5 | 61.2 | .01 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 20.5 | 70.2 | .73 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 4.5 | 61.2 | .01 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 17.5 | 71.7 | .00 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 19 | 75 | .00 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 71.7 | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 25 | 72 | .00 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 9 | 61 | .00 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 15 | 70 | .00 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |  |  |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |  | 65 |  |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |  |  | 2.43 |

## METEOROLOGICAL RECORD FOR OCTOBER, 1881.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.23 | 69°5 | 87 | 30.21 | 80°5 | 74 | 30.24 | 78°5 | 71 | 83°5 | 60°5 | 23° | 72° | .02 |
| 2 | 30.53 | 61.5 | 77 | 30.56 | 60 | 79 | 30.50 | 58.5 | 84 | 63.5 | 58 | 5.5 | 60.7 | .09 |
| 3 | 30.17 | 59 | 97 | 30.04 | 67 | 89 | 30.00 | 64 | 88 | 72 | 60 | 12 | 66 | .33 |
| 4 | 29.85 | 67.5 | 74 | 29.79 | 58.5 | 84 | 29.75 | 56.5 | 81 | 70.5 | 30.5 | 40 | 50.5 | .02 |
| 5 | 29.99 | 31 | 58 | 30.01 | 43 | 39 | 30.05 | 38 | 55 | 43 | 31.5 | 11.5 | 37.2 | .00 |
| 6 | 30.32 | 38.5 | 64 | 30.30 | 53.5 | 51 | 30.26 | 53 | 66 | 58.5 | 39 | 19.5 | 48.7 | .00 |
| 7 | 30.31 | 46.5 | 76 | 30.31 | 64 | 51 | 30.30 | 57.5 | 70 | 67 | 46.5 | 20.5 | 56.7 | .00 |
| 8 | 30.25 | 61 | 79 | 30.13 | 70.5 | 61 | 30.01 | 68 | 74 | 74 | 60.5 | 13.5 | 67.2 | .01 |
| 9 | 30.00 | 62 | 80 | 30.00 | 64 | 48 | 30.00 | 59 | 70 | 69.5 | 47.5 | 22 | 58.5 | .00 |
| 10 | 30.00 | 53 | 86 | 30.33 | 59 | 48 | 30.11 | 50 | 38 | 69.5 | 32.5 | 37 | 51 | .00 |
| 11 | 30.45 | 36 | 67 | 30.49 | 42.5 | 42 | 30.49 | 42 | 62 | 44.5 | 35 | 9.5 | 39.7 | .00 |
| 12 | 30.45 | 42 | 83 | 30.40 | 56 | 60 | 30.32 | 54 | 74 | 57.5 | 54 | 3.5 | 55.7 | .00 |
| 13 | 30.17 | 57.5 | 84 | 30.06 | 71 | 71 | 30.00 | 71 | 75 | 74 | 38.5 | 35.5 | 56.2 | .00 |
| 14 | 30.30 | 40 | 49 | 30.35 | 45 | 53 | 30.35 | 44.5 | 60 | 49 | 40.5 | 8.5 | 44.7 | .00 |
| 15 | 30.35 | 49 | 74 | 30.28 | 53 | 86 | 30.13 | 59 | 76 | 67 | 49 | 18 | 58 | .00 |
| 16 | 30.11 | 67 | 84 | 30.19 | 72 | 46 | 30.29 | 61.5 | 53 | 73 | 50 | 23 | 61.5 | .00 |
| 17 | 30.43 | 51.5 | 73 | 30.41 | 52 | 80 | 30.31 | 52 | 80 | 53.5 | 50 | 3.5 | 51.7 | .02 |
| 18 | 29.95 | 51 | 96 | 29.88 | 49 | 96 | 29.83 | 48 | 92 | 53 | 39 | 14 | 46 | .23 |
| 19 | 30.07 | 43 | 58 | 30.15 | 49 | 43 | 30.20 | 45 | 60 | 50.5 | 39.5 | 11 | 45 | .00 |
| 20 | 30.23 | 41.5 | 83 | 30.23 | 51 | 65 | 30.22 | 47.5 | 74 | 54 | 35.5 | 18.5 | 44.7 | .00 |
| 21 | 30.24 | 40 | 82 | 30.28 | 50 | 75 | 30.28 | 48.5 | 81 | 5[illegible]5 | 39.5 | 12 | 45.5 | .00 |
| 22 | 30.31 | 42 | 91 | 30.29 | 58 | 64 | 30.25 | 55.5 | 75 | 59.5 | 43 | 16.5 | 51.2 | .00 |
| 23 | 30.19 | 53 | 86 | 30.13 | 64 | 60 | 30.07 | 58.5 | 76 | 66 | 50.5 | 15.5 | 58.2 | .00 |
| 24 | 29.94 | 54.5 | 74 | 29.91 | 47.5 | 92 | 29.85 | 45.5 | 100 | 53.5 | 38.5 | 15 | 46 | .02 |
| 25 | 29.61 | 43 | 91 | 29.50 | 56 | 84 | 29.46 | 55.5 | 81 | 58.5 | 38.5 | 20 | 48.5 | .00 |
| 26 | 29.63 | 39 | 48 | 29.76 | 37.5 | 36 | 29.85 | 35 | 80 | 40.5 | 27.5 | 13 | 34 | .00 |
| 27 | 29.97 | 30 | 83 | 30.01 | 46.5 | 24 | 30.03 | 45.5 | 32 | 51.5 | 31 | 20.5 | 41.2 | .00 |
| 28 | 30.14 | 38.5 | 60 | 30.18 | 51 | 43 | 30.22 | 47 | 70 | 52.5 | 37.5 | 15 | 45 | .00 |
| 29 | 30.32 | 43 | 75 | 30.33 | 50 | 75 | 30.30 | 49 | 93 | 59.5 | 42 | 17.5 | 50.7 | .24 |
| 30 | 30.07 | 58.5 | 100 | 30.03 | 59 | 90 | 30.05 | 52 | 96 | 62.5 | 52 | 10.5 | 57.2 | .07 |
| 31 | 29.91 | 61 | 100 | 29.92 | 61 | 97 | 29.94 | 59 | 97 | 62 | 52.5 | 9.5 | 57.2 | .82 |

**Monthly range** .................................. 56°
**Monthly mean** .................................. 51°85
**Monthly rainfall** .................................. 1.87

## METEOROLOGICAL RECORD FOR NOVEMBER, 1881.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A.M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.06 | 52°5 | 77 | 30.09 | 52°5 | 73 | 30.10 | 50°5 | 86 | 55° | 48°5 | 6°5 | 51°7 | .01 |
| 2 | 30.16 | 48 | 93 | 30.16 | 50 | 93 | 30.12 | 50 | 93 | 53 | 48 | 5 | 50.5 | .04 |
| 3 | 29.92 | 53 | 100 | 29.78 | 58.5 | 97 | 29.67 | 60 | 94 | 63.5 | 42 | 21.5 | 52.7 | .28 |
| 4 | 29.44 | 42 | 91 | 29.48 | 45 | 72 | 29.54 | 41 | 69 | 47.5 | 32.5 | 15 | 40 | .21 |
| 5 | 29.99 | 34.5 | 76 | 30.12 | 47 | 48 | 30.14 | 45 | 76 | 53.5 | 36 | 17.5 | 44.7 | .00 |
| 6 | 30.17 | 51.5 | 83 | 30.19 | 59 | 44 | 30.26 | 47.5 | 52 | 59 | 35.5 | 23.5 | 47.2 | .00 |
| 7 | 30.43 | 38.5 | 82 | 30.51 | 46 | 69 | 29.55 | 45 | 84 | 48 | 39 | 9 | 43.5 | .00 |
| 8 | 30.50 | 48 | 92 | 30.44 | 50.5 | 96 | 30.38 | 51.5 | 100 | 52.5 | 39 | 13.5 | 45.7 | .10 |
| 9 | 30.21 | 51.5 | 96 | 30.07 | 62 | 97 | 30.00 | 65 | 73 | 66.5 | 41.5 | 25 | 54 | .19 |
| 10 | 30.20 | 43 | 62 | 30.20 | 49.5 | 41 | 30.23 | 44 | 73 | 51 | 30 | 21 | 40.5 | .00 |
| 11 | 30.39 | 31.5 | 54 | 30.40 | 38 | 40 | 30.40 | 35.5 | 50 | 41 | 30.5 | 10.5 | 35.7 | .00 |
| 12 | 30.36 | 31.5 | 58 | 30.26 | 39.5 | 60 | 30.10 | 44.5 | 96 | 51 | 30 | 21 | 40.5 | .44 |
| 13 | 29.73 | 39.5 | 86 | 29.74 | 53.5 | 54 | 29.75 | 46.5 | 51 | 54 | 39.5 | 14.5 | 46.7 | .00 |
| 14 | 29.90 | 40 | 73 | 29.98 | 49 | 50 | 30.02 | 44 | 59 | 50 | 37.5 | 12.5 | 43.7 | .02 |
| 15 | 30.11 | 38.5 | 76 | 30.11 | 39 | 60 | 30.24 | 38 | 64 | 41.5 | 32.5 | 9 | 37 | .06 |
| 16 | 30.55 | 32.5 | 75 | 30.59 | 42 | 63 | 30.58 | 39 | 73 | 43.5 | 34 | 9.5 | 38.7 | .00 |
| 17 | 30.61 | 36 | 76 | 30.57 | 50 | 54 | 30.50 | 47.5 | 70 | 55 | 43 | 12 | 49 | .00 |
| 18 | 30.11 | 55 | 81 | 30.00 | 59 | 79 | 29.94 | 56.5 | 84 | 61.5 | 41.5 | 20 | 51.5 | .72 |
| 19 | 29.91 | 41.5 | 91 | 29.90 | 40.5 | 91 | 29.84 | 41.5 | 91 | 43 | 33 | 10 | 38 | 1.03 |
| 20 | 29.99 | 33 | 51 | 30.06 | 34.5 | 43 | 30.35 | 32.5 | 50 | 36.5 | 30.5 | 6 | 33.5 | .00 |
| 21 | 30.45 | 34 | 70 | 30.37 | 43 | 62 | 30.26 | 44 | 59 | 45 | 33.5 | 11.5 | 39.2 | .00 |
| 22 | 30.11 | 33.5 | 57 | 30.25 | 28.5 | 77 | 30.31 | 23.5 | 80 | 34.5 | 15 | 19.5 | 24.7 | .00 |
| 23 | 30.59 | 18 | 76 | 30.34 | 30.5 | 62 | 30.22 | 36 | 71 | 38 | 19 | 19 | 28.5 | .42 |
| 24 | 29.86 | 29.5 | 88 | 29.75 | 38.5 | 68 | 29.71 | 32 | 54 | 41 | 20 | 21 | 30.5 | .00 |
| 25 | 29.95 | 21 | 29 | 30.18 | 29.5 | 51 | 30.26 | 26.5 | 57 | 31 | 21 | 10 | 26 | .00 |
| 26 | 30.29 | 31 | 78 | 30.22 | 38.5 | 47 | 30.18 | 39 | 64 | 44 | 34 | 10 | 39 | .00 |
| 27 | 30.14 | 32.5 | 84 | 30.09 | 45 | 53 | 30.02 | 41.5 | 66 | 47 | 15.5 | 31.5 | 31.2 | .00 |
| 28 | 30.14 | 16 | 82 | 30.32 | 23.5 | 47 | 30.40 | 25.5 | 62 | 32 | 16 | 16 | 24 | .00 |
| 29 | 30.45 | 31.5 | 84 | 30.40 | 48 | 81 | 30.32 | 46 | 76 | 49.5 | 32.5 | 17 | 41 | .00 |
| 30 | 30.22 | 41.5 | 87 | 30.19 | 55.5 | 65 | 30.17 | 52 | 70 | 58 | 42.5 | 15.5 | 50.2 | .07 |

Monthly range........................................ 51°5
Monthly mean........................................ 40°66
Monthly rainfall..... ............................... 3.59

## METEOROLOGICAL RECORD FOR DECEMBER, 1881.

| Date. | 8 A. M. |  |  | 1 P. M. |  |  | 6 P. M. |  |  | 24 hours ending 8 A. M. |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.00 | 46° | 92 | 29.72 | 57° | 97 | 29.70 | 54° | 77 | 58° | 33.5 | 24.5 | 45.7 | .18 |
| 2 | 30.23 | 33.5 | 70 | 30.34 | 41 | 66 | 30.38 | 36.5 | 71 | 41.5 | 32 | 9.5 | 36.7 | .00 |
| 3 | 30.40 | 32 | 75 | 30.39 | 41.5 | 70 | 30.35 | 41 | 66 | 43 | 32.5 | 10.5 | 37.7 | .08 |
| 4 | 30.34 | 38 | 72 | 30.34 | 39.5 | 60 | 30.35 | 36.5 | 76 | 40.5 | 37 | 3.5 | 38.7 | .00 |
| 5 | 30.36 | 38.5 | 72 | 30.37 | 41 | 83 | 30.37 | 38 | 64 | 43 | 29 | 14 | 36 | .00 |
| 6 | 30.33 | 29 | 66 | 30.27 | 40 | 73 | 30.22 | 39.5 | 77 | 43 | 30 | 13 | 36.5 | .01 |
| 7 | 29.91 | 43 | 91 | 29.73 | 47.5 | 85 | 29.61 | 46.5 | 76 | 49 | 30.5 | 18.5 | 39.7 | .28 |
| 8 | 29.63 | 30.5 | 63 | 29.75 | 39 | 82 | 29.84 | 34.5 | 62 | 40 | 29.5 | 10.5 | 34.7 | .00 |
| 9 | 30.00 | 32.5 | 70 | 30.03 | 44 | 55 | 30.04 | 40.5 | 52 | 45 | 28 | 17 | 36.5 | .00 |
| 10 | 30.11 | 28 | 49 | 30.14 | 25.5 | 27 | 30.18 | 20.5 | 42 | 29 | 11 | 18 | 20 | .00 |
| 11 | 30.32 | 12 | 23 | 30.34 | 25 | 49 | 30.36 | 23.5 | 67 | 28 | 11.5 | 16.5 | 19.7 | .00 |
| 12 | 30.47 | 26.5 | 82 | 30.49 | 36 | 63 | 30.55 | 37.5 | 76 | 45 | 28 | 17 | 36.5 | .01 |
| 13 | 30.23 | 41 | 91 | 30.19 | 47.5 | 81 | 30.11 | 50.5 | 86 | 58.5 | 41.5 | 17 | 50 | .00 |
| 14 | 29.96 | 58.5 | 82 | 29.87 | 63 | 80 | 30.84 | 56 | 84 | 63.5 | 30.5 | 33 | 47 | .36 |
| 15 | 30.09 | 30 | 78 | 30.17 | 27.5 | 55 | 30.24 | 26 | 63 | 30.5 | 12 | 18.5 | 21.2 | .00 |
| 16 | 30.43 | 12.5 | 61 | 30.47 | 25 | 32 | 30.52 | 23.5 | 54 | 27 | 12 | 15 | 19.5 | .00 |
| 17 | 30.47 | 27 | 82 | 30.43 | 38.5 | 55 | 30.38 | 36 | 63 | 40 | 28 | 12 | 34 | .00 |
| 18 | 30.27 | 33.5 | 66 | 30.24 | 46 | 54 | 30.25 | 41 | 61 | 48 | 33 | 15 | 40.5 | .00 |
| 19 | 30.37 | 33 | 79 | 30.42 | 42 | 66 | 30.43 | 38 | 76 | 43 | 32.5 | 10.5 | 37.7 | .00 |
| 20 | 30.38 | 33 | 84 | 30.33 | 47 | 62 | 30.28 | 42.5 | 66 | 47.5 | 32 | 15.5 | 39.7 | .00 |
| 21 | 30.32 | 32 | 64 | 30.40 | 40.5 | 56 | 30.43 | 36 | 71 | 47.5 | 32.5 | 15 | 40 | .00 |
| 22 | 30.41 | 38.5 | 82 | 30.27 | 44.5 | 84 | 30.03 | 47 | 93 | 54 | 39 | 15 | 46.5 | .17 |
| 23 | 29.61 | 48.5 | 93 | 29.57 | 38.5 | 91 | 29.61 | 31 | 89 | 49 | 17 | 32 | 33 | .09 |
| 24 | 29.96 | 17 | 59 | 30.13 | 23 | 40 | 30.21 | 22 | 31 | 26 | 18 | 8 | 22 | .00 |
| 25 | 30.34 | 25 | 74 | 30.33 | 39.5 | 60 | 30.32 | 39 | 64 | 42 | 25 | 17 | 33.5 | .00 |
| 26 | 30.26 | 36 | 85 | 30.25 | 46 | 65 | 30.23 | 48.5 | 71 | 51 | 37.5 | 13.5 | 44.2 | .33 |
| 27 | 30.14 | 47.5 | 100 | 30.06 | 45.5 | 100 | 29.96 | 43.5 | 100 | 48.5 | 40.5 | 8 | 44.5 | .58 |
| 28 | 29.95 | 41 | 95 | 29.96 | 44.5 | 84 | 29.99 | 45 | 84 | 47 | 41 | 6 | 44 | .01 |
| 29 | 30.01 | 43 | 92 | 29.95 | 41.5 | 100 | 29.73 | 44.5 | 100 | 52.5 | 42 | 10.5 | 47.2 | .57 |
| 30 | 29.26 | 42 | 75 | 29.29 | 43 | 68 | 29.39 | 39 | 64 | 45 | 31.5 | 13.5 | 38.2 | .00 |
| 31 | 29.54 | 31.5 | 89 | 29.54 | 37.5 | 51 | 29.55 | 32 | 79 | 39 | 28 | 11 | 33.5 | .00 |

Monthly range ........................................ 52.5
Monthly mean........................................ 36.64
Monthly rainfall........................................ 2.97
Total rainfall for the year.................................41.03 inches.

# ELEVENTH ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD

OF THE

# CITY OF LYNN,

## FOR THE YEAR ENDING DEC. 31, 1882.

---

*Compliments of the*

*Public Water Board.*

**Please Exchange.** *Lynn, Mass.*

# ELEVENTH ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD

OF THE

# CITY OF LYNN,

## FOR THE YEAR ENDING DEC. 31, 1882.

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*Compliments of the*

*Public Water Board,*

**Please Exchange.** *Lynn, Mass.*

# PUBLIC WATER BOARD.

---

## OFFICERS FOR 1882.

**EDWIN WALDEN,** ***President,***
**For four years.**

**THOMAS B. NEWHALL,**
**For five years.**

**JOSEPH M. ROWELL,**
**For three years.**

**JAMES N. BUFFUM,**
**For two years.**

DAVID H. SWEETSER.
For one year.

*Superintendent and Clerk.*
DANIEL WALDEN.

*Water Registrar,*
SIMON J. RONEY.

*Inspector.*
CHARLES H. CLIFFORD.

*Pumping Engineer,*
WILLIAM H. MESSINGER.

*Foreman of Piping,*
EDWIN MAXWELL,

# PUBLIC WATER BOARD.

## OFFICERS FOR 1883.

**JAMES N. BUFFUM**, *President*,
For one year.

**ALBERT A. DAVIS**,
For five years.

**THOMAS B. NEWHALL**,
For four years.

**EDWIN WALDEN**,
For three years.

**JOSEPH M. ROWELL**,
For two years.

*Superintendent and Clerk*,
**JAMES W. LYONS.**

*Water Registrar*,
**FRANK DAVIS.**

# ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD.

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Office of the Public Water Board,
*January 24th, 1883.*

*To the City Council of the City of Lynn:—*

The Eleventh Annual Report of the Public Water Board, furnishing an account of the official acts and doings of the Board for the year 1882, is hereby presented. The Report of the Superintendent of the Works, and that of the Water Registrar, as made to the Board at the close of the year, are hereto appended. These reports set forth so fully the condition of the works and the financial standing of the department, that only brief allusions to the facts they furnish seem to be necessary in the report of the Board.

## RECEIPTS AND EXPENDITURES.

The Receipts of the Department for the year 1882, for all purposes, were $97,912.05. Of this sum $4,631.72 were received for extra pipe laid, labor, etc.; which sum deducted from the gross amount received leaves as the legitimate receipts of the department the sum of $93,280.33. The receipts from water rents in 1881 were $80,389.30; the increase in receipts for the year 1882, as compared with the previous year, was $12,891.03. Of this increase, $3,000 was derived from the increased appropriation made by the City Council for water for fire purposes, — the real increase in receipts from water-takers being $9,891.03.

The expenses for maintenance the past year amounted to $12,577.04; a reduction in expenses as compared with the year 1881 of $1,021.76; the difference being largely due to the item of cost in running the tubular wells in the last-named year.

The interest payments on the water debt the past year amounted to $54.065.62, this amount showing an increase in interest payments of $875.62 as compared with the previous year. The interest charges against this department will of course increase with the yearly increase of the water debt; for it is to be remembered that all excess of earnings by the department, after discharging the expenses of maintenance and the payment of interest on the debt incurred for construction, is carried to the Water Loan Sinking Fund, so that neither the surplus earnings, or the income derived from them, become a credit for use until the maturity of some portion of the water debt.

The exhibit which shows the income and expenses of the department for the year 1882 is as follows: — Total revenue — which is the amount of all the charges made to water-takers, less abatements made, — $94,419.52; interest charges,

$54,065.62; maintenance account, $12,577.04; total for interest and maintenance, $66,642.66; excess of earnings over interest and maintenance, $27,776.86.

The outlay on account of construction was $38,196.55. Of this amount, $25,826.41 was expended in putting in new lines of distribution pipes, hydrants and gates, in streets not heretofore supplied with water. $8,885.70 was expended in the laying of small size iron pipes in courts and places, and for new service pipes in answer to applications for a supply of water. $2,030.63 was paid for building a retaining wall and raising the road-bed at the northerly end of Breed's Pond; and $942.50 for the fence erected during the year at the street front of the engine house lot.

The expenditure on account of construction the past year exceeded that of the previous year by the sum of $13.765.79. This increase is almost wholly due to the laying of an unusual amount of distribution pipe ordered by the City Council. In the judgment of the Board, much of this outlay was uncalled for; there being upon some of the streets piped but few houses, and no promise of an adequate return from water-takers for the additional burden of interest the department will be required to bear. As the Board is expected to execute all orders of the City Council requiring streets to be piped, the responsibility for large expenditure in sparsely settled streets, where expensive rock excavation is required, is with those who have this authority to order the work to be done. The Board has no discretion.

## COST OF THE WORKS.

| | | |
|---|---|---|
| Total gross cost of the works, Jan. 1st, 1882 | | $1,108,665 61 |
| Add construction account for 1882 | | 38,196 55 |
| Total gross cost of works Jan. 1st, 1883 | | $1.146,862 16 |
| Less receipts for pipe, labor, etc | $42,300 31 | |
| Less premiums on bonds sold | 9,750 00 | |
| Less income in excess of interest payments and cost of maintenace* | 72,095 90 | 124,146 21 |
| Net cost of works Jan. 1st, 1883 | | $1,022.715 95 |

* This amount includes no appropriation to Water Loan Sinking Fund made by the City Council, or earnings of the fund since it was established.

## WATER CONSUMPTION.

The quantity of water drawn from the distributing reservoir to supply the city the past year was 551,428,907 gallons, showing an increase in the quantity used, when compared with the consumption of the year 1881, of 84,342,873 gallons. So considerable an increase in the aggregate consumption in a single year is at first somewhat surprising, and suggests that the usual economy in the use of water has not been practised. But when it is seen that the daily per capita consumption was increased only 2-10 of a gallon in an unusually dry year, we discover that the large quantity of water used was due almost wholly to the additional number of takers who have, during the year, become connected with the supply, and to the larger use of water by those whose names were already upon the Registrar's books. This is also shown by the large increase in the number of fixtures in use at the close of the year as reported by the Registrar; a comparison with the year 1881 showing the gain in 1882 to be 1420 faucets, an increase in the number of closets of 391 and 128 hand hose.

There were put in during the past year 491 services, 30 more than in 1881: these supply water to 705 dwellings, 724 families, 92 stores and shops, 12 saloons, 16 stables, 11 stationary engines, 4 factories and 9 greenhouses. This large increase in the number of consumers — the greatest in any year since the works were constructed — fully accounts for the considerable increase in the water consumption, and unless some way can be devised to lessen the quantity of water used, the consumption for the coming year must be considerably increased over that of the year 1882. As a comparison of the per capita consumption of water in this city with that of nearly all of the cities and towns in the United States supplied with water, and having a population of 10,000 to 50,000, shows that we are using less than 50 per cent. of the common average, we can hardly hope to make practicable any plan to reduce the consumption in Lynn.

## SOURCES OF SUPPLY.

The Superintendent states in his report that the consumption of water in the last four years has exceeded the available supply to the ponds by 66½ millions gallons; and that the consumption for the past year has been 75 millions gallons in excess of the available rainfall. The deficiency which these figures show has been supplied by bringing into use the tubular wells and by drawing upon the quantity of water in store at the commencement of the term named. This is an alarming statement, and suggests immediate attention to the matter of increasing the supply. There can no longer be doubts as to the necessity of so doing. Even if we were certain that there would be no increase in the number of takers, we cannot afford to take the risk which the present condition of our water sources so plainly show we are taking, of a short supply. If we assume that the wells will yield continuously as large a quantity of water as at the former test; that they will be kept in use 24 hours a day for the entire year, and that the water drawn from them will be unexceptionable in quality, (a condition of things nowise probable), we should add to our supply but 150 millions of gallons. That quantity added to the yearly yield of our storage reservoirs will afford but 75 millions gallons in excess of the deficiency reported for the past year, and if the number of takers the coming year be increased to the same extent as last year, the small excess the above figures show would be quite exhausted.

The opinions of the Board heretofore expressed in their annual reports, both as to the necessity of increasing the supply and the sources from which a further supply should be obtained, are too well known to require a re-statement. We conclude our report by urging upon the attention of the city council an early consideration of these important matters.

EDWIN WALDEN,
THOMAS B. NEWHALL,
DAVID H. SWEETSER.

# REPORT OF THE WATER REGISTRAR.

---

*Hon. Edwin Walden, President of the Public Water Board:*

DEAR SIR:—In accordance with the requirements of the City Ordinances, I herewith present the Report of the Water Registrar for the year ending Dec. 31, 1882.

## SERVICES.

The whole number of services Jan. 1, 1882, was 4948; number of new services put in during the year, 491; total number Jan. 1, 1883, 5439.

There was shut off during the year for non-payment of rates, 23; let on again by payment of rates and fines, 16; let on for other parties, the premises having changed owners, 1; let on by order of the Court, 1; still remaining off, 5; number let on, that was shut off previous to 1882, 4.

At the beginning of the year there were 49 services remaining off—premises vacant; there have been shut off during the year, by request or for vacancies, 118; let on again—premises re-occupied, 116; still remaining off, 52.

There has been 3 new services put in at East Saugus during the year, making the whole number in that place up to Jan. 1, 1883, 56.

The ratio of increase in the number of services for the last eight years, is as follows:—

| | | | |
|---|---|---|---|
| In 1875......5.25 | per cent. | In 1879......6.04 | per cent. |
| In 1876......6.54 | " " | In 1880......8.75 | " " |
| In 1877......7.60 | " " | In 1881.....10.25 | " " |
| In 1878......6.14 | " " | In 1882......9.92 | " " |

The fixtures of water-takers supplied with city water, have not been examined as thoroughly as in former years, from the fact that one inspector is not able to examine all the premises of water-takers, because of the large increase from year to year, and of other duties required of him; but so far as could be, the work in this department has been carried on, and when fixtures were found to be out of order and leaking, the owners were notified to have them put in good repair immediately, or the water would be shut off from their premises; and all such cases coming to the notice of the department, were attended to at once, so that no service has been shut off during the year for non-compliance with the rules and regulations in this respect.

I would again respectfully call the attention of the Board to the fact that one inspector cannot examine all the fixtures of water-takers in the city each year; and to obtain all rates properly belonging to the city, as well as to check the waste of water, would seem to warrant a thorough inspection of all fixtures.

## RECEIPTS FOR THE YEAR 1882.

| | | |
|---|---|---|
| For the use of water for all purposes | $93,098 73 | |
| For fines — shutting off and letting on | 40 00 | |
| For rent | 25 00 | |
| For summonses | 116 60 | |
| | | $93,280 33 |
| For extra pipe, labor, etc. | | 4,631 72 |
| Total receipts | | $97,912 05 |

All of which has been paid into the city treasury, and the Treasurers' receipts taken therefor.

There is due on ordinary water rates, $538.25; on meter rates, $3,813.15; on account of extra pipe, $381.95.

## EXPENDITURES FOR 1882.

### MAINTENANCE.

| | | |
|---|---|---|
| Salaries and office expenses | $3,368 48 | |
| Repairs on services and meters | 1,800 78 | |
| Repairs on Boilers | 25 00 | |
| Repairs on main hydrants and gates | 1,404 73 | |
| Repairs on engine house | 2 20 | |
| Pumping, wages, coal, oil, &c. | 5,148 08 | |
| Stable and workshop | 644 03 | |
| Tubular wells | 2 50 | |
| Birch Pond | 4 18 | |
| Breed's Pond | 147 05 | |
| Reservoir | 30 01 | |
| Total maintenance | | $12,577 04 |

## CONSTRUCTION.

| | | |
|---|---|---|
| Services and court mains | $8,885 70 | |
| Mains, hydrants and gates | 25,826 41 | |
| Meters | 473 11 | |
| Breed's Pond | 2,030 63 | |
| Birch Pond | 10 00 | |
| Tubular Wells | 28 20 | |
| Engine House and lot | 942 50 | |
| Total construction | | $38,196 55 |

## COMPARATIVE STATEMENT OF REVENUE FOR 1882.

| | | |
|---|---|---|
| Amount collected in 1882, | $93,280 33 | |
| Due and uncollected | 4,351 40 | |
| | | $97,631 73 |
| Deduct amount due at begining of year | | 3,212 21 |
| Revenue for 1882 | | 94.419 52 |
| Revenue for 1881 | | 80,967 76 |
| Increase of revenue for 1882 | | $13,451 76 |

## STATEMENT OF INTEREST MAINTENANCE AND REVENUE FOR 1882.

| | | |
|---|---|---|
| Revenue for 1882 | | $94,419 52 |
| Interest for 1882 | $54,065 62 | |
| Maintenance for 1882 | 12,577 04 | |
| | | 66,642 66 |
| Excess of revenue over interest and maintenance | | $27,776 86 |

Following will be found the usual tables exhibiting the number of dwellings, families, stores, factories, etc., etc., the yearly revenue of the department, the class of premises to which meters are attached, the number and kind of fixtures, etc.

All of which is respectfully submitted,

SIMON J. RONEY,
*Water Registrar.*

# STATEMENT

### SHOWING THE NUMBER OF FAMILIES, DWELLINGS, STORES, FACTORIES, ETC., SUPPLIED WITH CITY WATER FOR 1882.

| | |
|---|---|
| Dwellings | 4757 |
| Families | 7133 |
| Boarding-houses | 65 |
| Hotels | 9 |
| Stores and shops | 408 |
| Offices | 139 |
| Restaurants and Saloons | 61 |
| Stables | 246 |
| Stationary steam engines | 89 |
| Factories | 155 |
| Railroads | 3 |
| City fire engine houses | 4 |
| School-houses | 28 |
| Churches | 14 |
| Public halls and buildings | 15 |
| Printing offices | 9 |
| Green-houses | 18 |
| Bakeries | 9 |
| Barber shops | 18 |
| Planing mills | 3 |
| Machine and blacksmith shops | 13 |
| Markets | 8 |
| Banks | 6 |
| Photographers | 6 |
| Public and drinking fountains | 7 |
| Motors | 7 |
| Laundries | 4 |
| Reservoirs | 4 |
| Foundry | 1 |
| Private fountains | 16 |
| Gas works | 1 |
| Steam heating works | 1 |
| Old Ladies' Home | 1 |
| City Hall | 1 |
| Almshouse | 1 |
| Post Office | 1 |
| Hand hose | 1157 |
| Fire hydrants | 497 |

Servi

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# STATEMENT

## SHOWING THE NUMBER AND KIND OF FIXTURES CONTAINED WITHIN THE PREMISES OF WATER-TAKERS TO DEC. 31, 1882, COMPARED WITH THE PREVIOUS YEAR.

| Kind of fixtures. | 1881. | 1882. | Increase. |
|---|---|---|---|
| Faucets | 9485 | 10905 | 1420 |
| Bath tubs | 532 | 578 | 46 |
| Water closets | 1552 | 1943 | 391 |
| Urinals | 56 | 70 | 14 |
| Hand hose | 1029 | 1157 | 128 |

## STATEMENT

### EXHIBITING THE CLASS OF PREMISES TO WHICH METERS ARE ATTACHED.

| Class. | Size. | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | ¼ | ⅝ | ¾ | 1 | 1¼ | 1½ | 2 | 3 | |
| Factories | 3 | 22 | 38 | 30 | 1 | | | | 94 |
| Railroads | | | 6 | 1 | | | 2 | 1 | 10 |
| Engines | | 2 | 6 | 11 | 1 | 3 | | | 23 |
| Halls and buildings | | 1 | 2 | 5 | | | | | 8 |
| Hotels | | 1 | 2 | | | | | | 3 |
| Livery Stables | | 5 | | | | | | | 5 |
| Saloons | | | 1 | 3 | | | | | 4 |
| Laundry | | 1 | | | | | | | 1 |
| Gas Works | | | | | | 1 | | | 1 |
| Fire engine-house | | | | 1 | | | | | 1 |
| Dwelling | | 1 | | | | | | | 1 |
| Printing offices | | 2 | | | | | | | 2 |
| Medical Laboratory | | 1 | | 1 | | | | | 1 |
| Bath-rooms | | 1 | | | | | | | 1 |
| City stables | | | | 1 | | | | | 1 |
| Totals | 3 | 36 | 55 | 53 | 2 | 4 | 2 | 1 | 156 |

## COST OF THE WORKS TO JANUARY 1, 1883.

| | |
|---|---|
| Breed's Pond and land | $37,814 51 |
| Birch Pond and land | 43,640 07 |
| Pipe conduit and right of way | 43,785 98 |
| Reservoir and land | 131,482 30 |
| Force main and land | 24,614 00 |
| Engine house and land | 56,400 04 |
| Engine and boilers | 63,444 72 |
| Mains, hydrants and gates | 519,337 76 |
| Services and court mains | 137,145 15 |
| Meters | 5,964 74 |
| Workshop and stable | 1,785 99 |
| Engineering | 8,564 99 |
| Tubular wells | 6,223 96 |
| Total | $1,080,203 41 |
| **CREDIT.** | |
| By amount received for extra pipe | 42,303 31 |
| Net cost of the works | $1,037,900 10 |

# REPORT OF THE SUPERINTENDENT.

*Hon. Edwin Walden, President of the Public Water Board:*

SIR: — In compliance with the City Ordinance, I respectfully submit, herewith, the annual report of the Superintendent, for the year ending Dec. 31, 1882.

## PONDS.

On the first of January, 1882, the ponds contained a large surplus of water, supplied to them from the excessive rains of the previous year, with an average rainfall in the early months of the past year, and very favorable conditions for collecting a large percentage, they were both filled by the last of May, and 16,832,844 gallons were wasted over the flash boards; making a total waste in the last two years of 57,791,596 gallons, against 77,163,288 gallons pumped into Breeds Pond from the tubular wells in 1880 and 1881; the difference, 19,371,692 gallons was the quantity which the ponds lacked of being filled by the rainfall.

The only work done at Breed's Pond this year is the cleaning of the margin of the pond by the removal of a quantity of stumps that had been loosened by the ice and afterwards drifted ashore, and capping the retaining wall of the road at the head of the pond. No outlay has been made at Birch Pond this year. The supply to the city has been taken from both ponds since the first of June, and the water has proved of excellent quality. The depth of water in Breed's Pond, January 1st, 1882 was 13 feet, 4 inches; the depth in Birch Pond at the same date was 11 feet, 5 inches; the depth in Breed's Pond, January 1st, 1883 was 10 feet, 6 inches, and the depth in Birch Pond at the same date was 9 feet. The available amount of water in store in both ponds above a plane of 6 feet, January 1st, 1882 was 183,862,126 gallons; the available amount in store, January 1st, 1883, above the same place was 91,672,141 gallons, showing a loss during the year of 92,672,141 gallons.

The rainfall for the year has been 36.39 inches, and the yield of the watershed has been 476,031,890 gallons, or 54,55 per cent. of the rainfall equal to 19.85 inches over the entire drainage area, exclusive of water surfaces. The consumption for the year has been 551,428,907 gallons, 75 millions of gallons more than the amount received into the ponds from the rainfall.

The consumption has been larger than in any previous year. This is due to the large increase in population, and the consequent large increase in the number of new water takers. As the increase in receipts also keeps pace with the increase in consumption, it is a gratifying evidence of the prosperity of the city. The following facts showing the rate of increase for the last 6 years, divided into two periods of three years each, shows how much more rapidly the increase has has been in the last three years than in the first three, and may be of interest in connection with the means of the city to supply the increasing demand. In 1876 by the use of meters in all places where large waste was liable to occur in connection with a system of house inspection commenced at that time, the consumption was reduced to a minimum. The proportion of consumers deduced from the number of families supplied was 47.38 per cent. of the whole population. In 1879 the proportion of consumers to the population had risen to 60.61 per cent. The increase in consumption for the 3 years was 16.87 per cent. and the increase in receipts, exclusive of the amount paid by the city for hydrant service, $12,924.35, or 25.40 per cent. the increase in the number of services was 704 or 20.56 per cent. and the increase in the number of families 1484, or 40.84 per cent. The next 3 years brings us to 1882 when the proportion of consumers to the whole population has risen to 72.11 per cent. the increase in consumption but 19.39 per cent. and the increase in receipts, exclusive of the amount received for hydrant service, has been $21,488.86, or 33.68 per cent. the increase in the number of services, 1312 or 31.79 per cent. and the increase in the number of families supplied 2016, or 39.40 per cent. From this statement it will readily be seen that the ratio of increase in receipts, has been nearly double and the ratio of increase in families more than double the ratio of increase in consumption; showing clearly that the economy of our citizens in the use of the public supply is beyond that of most other cities, and that the economy practised is what has hitherto saved us from a water famine. With our rapidly increasing population and the increasing demand for water, even this economy cannot save us much longer.

In the last 4 years the consumption of water has exceeded the avilable amount received into the ponds from the rainfall by 66½ millions of gallons and in 1882 the excess of consumption above the available rainfall was 75 millions of gallons. For the coming year, unless we have a large rainfall, the ponds will hardly afford a sufficient supply and the deficit will have to be obtained from the Tubular Wells. With a rainfall similar to that of 1880 the Tubular Wells will hardly afford a sufficient quantity tc meet the deficiency.

In view of all these facts it must be evident to every reflecting man that the danger of a water famine is imminent and that immediate steps should be taken towards increasing the supply. Especially is this the case in view of the fact that one working season at least, must be consumed in the necessary work.

The recent reports of the growth of the city, published in the papers, show that a population equal to the total population of the Town of Swampscott, is being added to the city each year. If these estimates are correct, in two or three years at the farthest, all our present sources of supply will be inadequate to supply the demands that will be made upon them.

### TUBULAR WELLS.

At the Tubular Wells everything remains as at [illegible] the first of July the flow [illegible] gallons daily; since that time the [illegible] has been dammed up and kept [illegible] that no measurements could be taken. The boiler and pump have [illegible] ready for service.

## [illegible]

[illegible] good condition and has re[illegible] this year. A new platform [illegible] inlet and outlet gates which [illegible] a more substantial [illegible] shall be deemed advisable.

## PUMPING STATION.

[illegible] condition and has re[illegible]. A new and substan[illegible] in front of the lot. [illegible] improvement; in the [illegible] required.

[illegible] have required but slight [illegible] condition. The engine has [illegible] the year, and has made [illegible] pumping 549,803,988 gallons [illegible] against an average head of 166¼ [illegible] expenditure of 904,200 of coal, aver[illegible] gallons per pound of coal. The [illegible] has fallen off slightly from pre[illegible] in part to the poor quality of coal [illegible] first half of the year, and in part [illegible] the want of an overhaul. It has now been running ten years with an average cost for repairs of not much over $10 per year, and some of the parts are getting a little worn. It cannot have a thorough overhaul until a new pumping engine is procured, as we have nothing now which can supply its place, and in case of accident we should be placed in a very unpleasant position.

## PIPES.

During the year there has been laid in 38 different streets 21,084 feet of distributing mains varying in size from 4 to 12 inches, 1617 feet of 4 and 6 inch cast-iron pipe, and 106 feet cement lined pipe has been laid in the cemetery, and 2588 feet of smaller sizes has been laid in 13 courts as mains, making a total of 4 miles, 4,275 feet. 54 gates and 44 hydrants have been set in connection with the new pipe laid. The number of services put in this year is 491 of an aggregate length of 20,582 feet, making the total length of all sizes of pipe laid, 8 miles, 3,737 feet. In trenching for pipes more than 1700 linneal feet of ledge has been excavated. In addition to the services put in in the city, three services have been put in in East Saugus at the expense of the persons ordering them, four services not put in by the city have been taken up and renewed, six services have been lowered, and four have been extended at the cost of the owners; 137 leaks on pipes of all sizes have been repaired, three new hydrants have been set in place of old ones taken up, and thirty-seven have been repaired during the year. Two hundred and twenty-eight new stop boxes and thirty-three new gate boxes have been set to replace that number of old and decayed boxes, sixteen new meters have been set, and twenty-five have been taken out, cleaned and repaired and re-set.

Annexed please find the usual tables of work done, engine record and cost of pumping, rainfall, consumption of water, standing of the ponds, &c., and the meteorological record for the year.

All of which is respectfully submitted,

DANIEL WALDEN,

*Superintendent.*

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All of which is respectfully submitted,

DANIEL WALDEN,

*Superintendent.*

# TABLE I.

## ENGINE RECORD FOR THE YEAR ENDING DECEMBER 31, 1882.

| Date. | Number of pumping days. | Average pumping time per day. | Average pumping time per day. | Total pumping time per month. | Total pumping time per month. | Total number of revolutions per month. | Average revolutions per minute. | Coal consumed. | | | | Ashes and cinders. | Ashes and cinders. | Total number of gallons pumped per month, allowing 4 per cent. for loss of action in the pump. | Average number of gallons pumped into the reservoir per pound of coal. | Average number of gallons raised 100 feet high per pound of coal. | Average head against the pump. | Average duty in pounds of water raised one foot high per 100 lbs. of coal, calculated on the total coal consumed, no deduction made for ashes and cinders. | Average duty calculated on the total coal consumed, the ashes and cinders being deducted. | Average duty calculated on the coal consumed while running, no deduction being made for the ashes and cinders. | Average duty calculated on the coal consumed while running, the ashes and cinders being deducted. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Raising steam. | Pumping. | Banking. | Total. | | | | | | | | | | |
| Month. | Dys | H. | M. | H. | M. | Rev. | Rev | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | p. c. | Galls. | Galls. | Galls. | Feet. | Pounds. | Pounds. | Pounds. | Pounds. |
| January . . | 14 | 12 | 11 | 170 | 30 | 190,355 | 18.61 | 12,350 | 44,550 | 3,100 | 60,000 | 9,300 | 15.50 | 35,510,725 | 591.84 | 983.58 | 166.19 | 85,403,968 | 101,069,713 | 115,022,098 | 136,119,922 |
| February . | 15 | 12 | 04 | 181 | 05 | 202,075 | 18.59 | 13,000 | 47,050 | 3,300 | 63,350 | 9,000 | 14.20 | 37,697,191 | 595.09 | 990.65 | 166.48 | 86,017,059 | 100,230,914 | 115,816,805 | 134,984,319 |
| March. . . . | 18 | 12 | 07 | 218 | 10 | 243,096 | 18.61 | 15,600 | 57,250 | 4,000 | 76,850 | 11,045 | 14.37 | 45,461,488 | 591.56 | 983.44 | 166.26 | 85,391,391 | 99,723,856 | 114,625,823 | 133,864,966 |
| April . . . . | 16 | 12 | 07 | 194 | 10 | 216,874 | 18.61 | 13,750 | 49,450 | 3,700 | 66,900 | 9,500 | 14.20 | 40,457,845 | 614.75 | 1,008.48 | 166.43 | 87,391,139 | 101,854,829 | 118,229,872 | 137,797,378 |
| May . . . . | 15 | 12 | 09 | 182 | 15 | 201,250 | 18.40 | 13,600 | 46,050 | 3,000 | 62,650 | 8,500 | 13.57 | 37,543,187 | 599.25 | 996.67 | 166.37 | 86,506,551 | 100,155,022 | 117,774,037 | 136,259,344 |
| June . . . | 20 | 12 | 05 | 241 | 35 | 270,605 | 18.67 | 16,400 | 62,600 | 4,900 | 83,900 | 11,430 | 13.62 | 50,481,362 | 611.68 | 998.31 | 165.92 | 86,681,249 | 100,352,769 | 116,175,162 | 134,497,862 |
| July . . . . | 23 | 12 | 00 | 276 | 00 | 306,000 | 18.47 | 18,400 | 68,600 | 5,700 | 92,700 | 11,800 | 12.73 | 57,084,300 | 615.79 | 1,022.20 | 166.00 | 88,756,237 | 101,762,175 | 119,937,405 | 137,030,781 |
| August . . | 26 | 12 | 11 | 316 | 40 | 352,225 | 18.63 | 20,600 | 78,850 | 6,600 | 106,050 | 14,800 | 13.95 | 65,707,574 | 629.02 | 1,045.40 | 166.19 | 89,410,068 | 103,911,612 | 120,252,817 | 139,756,724 |
| September | 19 | 12 | 06 | 230 | 00 | 257,015 | 18.62 | 16,200 | 56,900 | 4,500 | 77,600 | 12,490 | 16.10 | 47,146,148 | 616.57 | 1,026.89 | 166.55 | 89,749,681 | 106,488,845 | 121,853,931 | 145,228,283 |
| October. . . | 16 | 12 | 10 | 194 | 45 | 217,735 | 18.63 | 13,600 | 49,000 | 3,600 | 66,200 | 10,200 | 15.41 | 40,618,404 | 613.57 | 1,017.22 | 165.79 | 88,323,704 | 104,411,236 | 119,327,127 | 141,058,822 |
| November. | 18 | 12 | 09 | 218 | 50 | 244,453 | 18.62 | 15,600 | 54,600 | 3,900 | 74,100 | 10,300 | 13.90 | 45,602,147 | 615.41 | 1,021.75 | 166.03 | 88,715,831 | 103,039,860 | 120,401,888 | 139,832,452 |
| December. | 18 | 12 | 10 | 219 | 10 | 244,940 | 18.63 | 15,150 | 54,550 | 4,200 | 73,900 | 11,150 | 15.09 | 45,093,557 | 618.31 | 1,029.95 | 166.57 | 89,429,519 | 105,320,182 | 121,151,997 | 142,986,659 |
| Tots & av's | 218 | 12 | 08 | 2643 | 10 | 2,947,220 | 18.58 | 184,250 | 669,450 | 50,500 | 904,200 | 129,515 | 14.39 | 549,803,988 | 607.73 | 1,010.24 | 166.23 | 87,619,653 | 102,357,584 | 118,380,747 | 138,318,954 |

## COST OF PUMPING.

| | | |
|---|---|---|
| 904.200 pounds of coal, average price per net ton, | $6 22.5 | $2,813 98 |
| 20.550 pounds of Coal, for heating average price per net ton. | 6 21.6 | 63 87 |
| 9 cords of wood, @ | 4 50 | 40 50 |
| Oil, waste, packing, &c | | 137 91 |
| Sundries | | 53 10 |
| Repairs on boilers and furnaces | | 27 20 |
| Wages of engineer and fireman | | 2,062 19 |
| Total | | $5,198 75 |
| Cost of Raising one million gallons into the reservoir | 9 45.56 | |
| Cost of raising one million gallons one fort high | 0 05.68 | |

# TABLE II.

## SHOWING THE CONSUMPTION OF WATER FOR THE YEAR ENDING DECEMBER 31, 1882,

| | Monthly consumption. | Average consumption per day. | Average daily increase. | Average daily decrease. | Average to each consumer. | Average to each inhabitant. |
|---|---|---|---|---|---|---|
| Month. | Gallons. | Gallons. | Gallons. | Gallons. | Galls. | Galls. |
| January .... | 40,123,167 | 1,294,296 | 148,432 | | 41.2 | 30.4 |
| February ... | 37,321,864 | 1,332,924 | 38,628 | | 42.5 | 31.3 |
| March....... | 42,333,663 | 1,397,860 | 64,936 | | 44.5 | 32.9 |
| April....... | 40,457,845 | 1,348,595 | | 49,265 | 42.9 | 31.7 |
| May......... | 41,046,339 | 1,324,075 | | 24,520 | 42.2 | 31.1 |
| June ....... | 50,418,808 | 1,680,627 | 356,552 | | 53.5 | 39.5 |
| July ....... | 57,209,409 | 1,845,478 | 164,851 | | 58.8 | 43.4 |
| August..... | 62,850,868 | 2,027,447 | 181,669 | | 64.6 | 47.7 |
| September.. | 47,559,409 | 1,585·314 | | | 50.5 | 37.3 |
| October .... | 45,291,298 | 1,461,009 | | 442,133 | 46.5 | 34.4 |
| November .. | 42,341,620 | 1,411,387 | | 124,305 | 44.9 | 33.2 |
| December .. | 44,474,617 | 1,434,665 | 23,258 | 49,622 | 45.7 | 33.7 |
| To. and av. | 551,428,907 | 1,510,764 | | | 48.1 | 35.6 |

# TABLE III.

## SHOWING THE AMOUNT OF RAINFALL ON WATER SHED OF BOTH PONDS, AMOUNT OF WATER DRAWN FROM THE PONDS, AMOUNT WASTED FROM THE PONDS, AMOUNT RECEIVED INTO THE PONDS, AND PERCENTAGE OF RAINFALL AVAILABLE FOR USE, FROM 1874 TO 1882, BOTH INCLUSIVE.

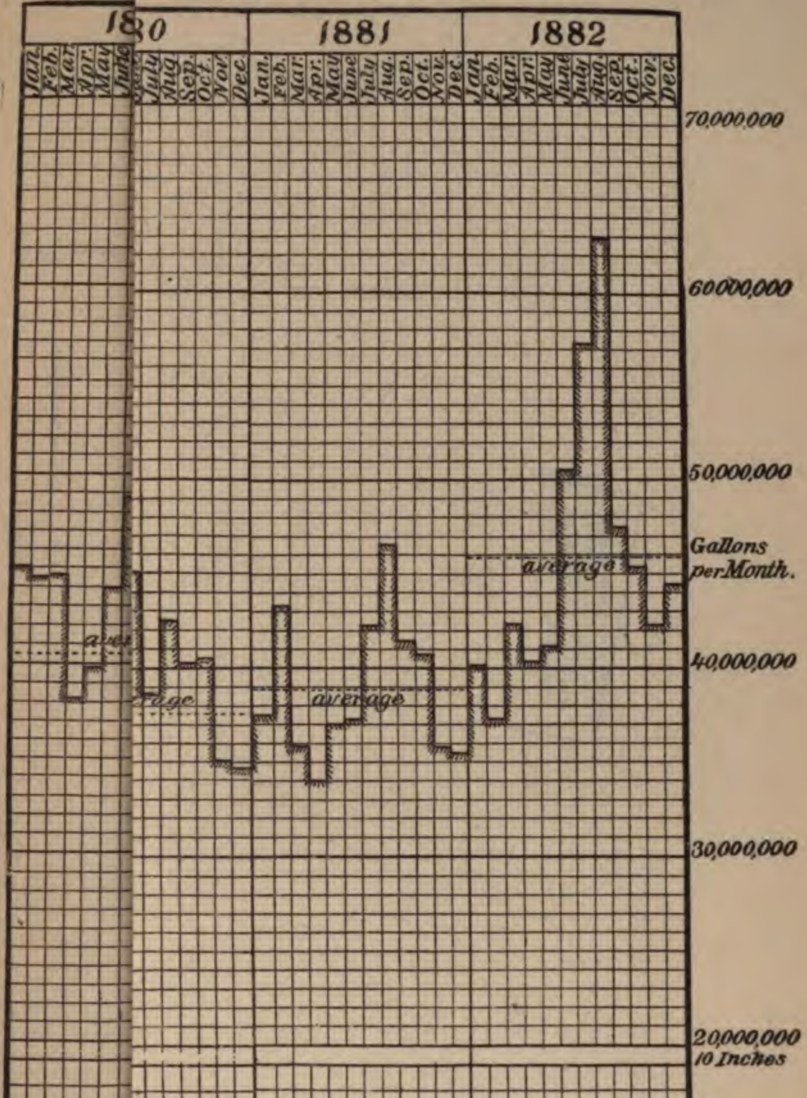
| Date. | Rainfall. | Amount of rainfall on the water shed of the Ponds. | Amt. of water drawn from the Ponds for consumption. | Amount of water wasted from the Ponds for the year. | Total amount consumed and wasted during the year. | Increase in the Ponds during the year. | Decrease in the Ponds during the year. | Total amount of the rainfall received into the Ponds. | Daily average. | Percentage of the rainfall received into the Ponds. |
|---|---|---|---|---|---|---|---|---|---|---|
| Year. | Inches. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Gallons. | Per ct. |
| 1874 | 34.92 | 837,154,949 | 485,189,801 | 21,200,000 | 506,389,801 | | 47,545,394 | 458,844,407 | 1,257,108 | 54.81 |
| 1875 | 41.85 | 1,003,305,644 | 471.387,757 | 11,609,267 | 482,997,024 | 60,281.293 | | 543,278,317 | 1,488,433 | 54.24 |
| 1876 | 45.05 | 1,080,099,392 | 395,084,629 | 20,500,000 | 415,584,629 | 74,452,111 | | 490,036,740 | 1.342,566 | 45.37 |
| 1877 | 45.65 | 1,094,484,734 | 402,161,193 | 131,271,511 | 533,438,704 | 60,846,704 | | 594,285,408 | 1,628,179 | 54.29 |
| 1878 | 57.36 | 1,379,911,034 | 417,678,296 | 205,081,247 | 622,759,543 | 64,712,199 | | 687,471,742 | 1,883,484 | 49.82 |
| 1879 | 41.04 | 983,957,360 | 456,319,019 | 164,095,022 | 620,414,041 | | 203,370,014 | 417,044,027 | 1,142,586 | 42.38 |
| 1880 | 37.28 | 893.809,219 | 401,905,570 | | 401,905,570 | | 49,803,426 | 352,102,144 | 964,663 | 39.38 |
| 1881 | 46.31 | 1.110,771,709 | 439,992,684 | 42,355,919 | 482,348,603 | 138,262,844 | | 620,611,447 | 1,700,305 | 55.87 |
| 1882 | 36.39 | 872.470,956 | 551.428.997 | 16.792,968 | 568,221,875 | | 92,189,985 | 476.031,890 | 1,304,197 | 54.56 |

# TABLE IV.

## SHOWING THE DEPTH OF WATER IN THE PONDS FOR EACH WEEK DURING THE YEAR 1882.

| Date. | Breed's Pond. | | Birch Pond. | | Date. | Breed's Pond. | | Birch Pond. | | Date. | Breed's Pond. | | Birch Pond. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ft. | In. | Ft. | In. | | Ft. | In. | Ft. | In | | Ft. | In. | Ft. | In. |
| Jan. 7 | 13 | 8½ | 11 | 3 | May 6 | 20 | 0 | 13 | 8½ | Sep. 2 | 14 | 7 | 10 | 8 |
| " 14 | 14 | 3 | 11 | 3 | " 13 | 19 | 11 | 13 | 7½ | " 9 | 14 | 0½ | 10 | 5 |
| " 21 | 14 | 8 | 10 | 11 | " 20 | 20 | 3½ | 14 | 0 | " 16 | 13 | 10 | 10 | 6 |
| " 28 | 15 | 3 | 10 | 10 | " 27 | 20 | 10 | 14 | 6¾ | " 23 | 13 | 9 | 10 | 8½ |
| Feb. 4 | 15 | 9 | 11 | 1½ | June 3 | 20 | 11 | 14 | 6¼ | " 30 | 13 | 7 | 10 | 9 |
| " 11 | 16 | 2 | 11 | 4½ | " 10 | 20 | 10 | 14 | 5 | Oct. 7 | 13 | 2 | 10 | 7½ |
| " 18 | 17 | 1½ | 12 | 1 | " 17 | 20 | 6½ | 14 | 2½ | " 14 | 12 | 10½ | 10 | 6½ |
| " 25 | 18 | 0½ | 12 | 5½ | " 24 | 20 | 2½ | 13 | 10½ | " 21 | 12 | 7½ | 10 | 6 |
| Mar. 4 | 19 | 2½ | 13 | 6 | July 1 | 19 | 10 | 13 | 6½ | " 28 | 12 | 3½ | 10 | 3½ |
| " 11 | 20 | 2½ | 14 | 1½ | " 8 | 19 | 6 | 13 | 2½ | Nov. 4 | 11 | 10½ | 10 | 2½ |
| " 18 | 20 | 5½ | 14 | 1½ | " 15 | 19 | 2 | 12 | 10 | " 11 | 11 | 5½ | 10 | 1 |
| " 25 | 20 | 5 | 14 | 1 | " 22 | 18 | 8 | 12 | 5½ | " 18 | 11 | 3 | 9 | 11 |
| Apr. 1 | 20 | 5 | 14 | 1 | " 29 | 18 | 0½ | 12 | 2 | " 25 | 11 | 0 | 9 | 8 |
| " 8 | 20 | 5 | 14 | 1 | Aug. 5 | 17 | 3½ | 11 | 10½ | Dec. 2 | 10 | 9½ | 9 | 6 |
| " 15 | 20 | 2½ | 13 | 10½ | " 12 | 16 | 7 | 11 | 6½ | " 9 | 10 | 8 | 9 | 4 |
| " 22 | 20 | 1 | 13 | 9½ | " 19 | 15 | 11 | 11 | 3 | " 16 | 10 | 7½ | 9 | 3 |
| " 29 | 20 | 1½ | 13 | 9½ | " 26 | 15 | 4 | 10 | 11½ | " 23 | 10 | 6 | 9 | 1½ |
| | | | | | | | | | | " 30 | 10 | 5½ | 9 | 0 |

FOR THE LAST 9 YEARS.



# TABLE V.

## SHOWING THE RAINFALL AT THE PUMPING STATION FOR THE YEAR 1882.

| Day of the month. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .45 | .... | .95 | .... | .... | .06 | .55 | .... | .... | .... | .... | .... |
| 2 | .... | .09 | .35 | .... | .02 | .... | .... | .... | .... | .... | .... | .... |
| 3 | .... | .... | .01 | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 4 | .... | 1.00 | .... | .08 | .... | .33 | .12 | .... | .01 | .... | .... | .... |
| 5 | .... | .14 | .01 | .... | .... | .... | .47 | .... | .... | .... | .... | .21 |
| 6 | .28 | .... | .12 | .05 | .... | .... | .... | .... | .... | .... | .01 | .... |
| 7 | .... | .10 | .... | .02 | .... | .... | .... | .... | .... | .... | .03 | .16 |
| 8 | .... | .... | .... | .... | .45 | .... | .... | .27 | .43 | .... | .... | .... |
| 9 | .... | .69 | .40 | .01 | .... | .... | .... | .... | .06 | .... | .... | .15 |
| 10 | .31 | .23 | .... | .... | .... | .26 | .... | .... | .... | .... | .... | .21 |
| 11 | .32 | .... | .... | .... | .08 | .... | .... | .... | 2.96 | .... | .... | .22 |
| 12 | .... | .... | .08 | .... | .29 | .... | .35 | .... | .08 | .... | .... | .... |
| 13 | .31 | .02 | .... | .... | .20 | .... | .17 | .... | .... | .13 | .12 | .37 |
| 14 | .01 | .... | .... | .... | 1.20 | .... | .... | .... | .48 | 1.31 | .... | .... |
| 15 | .... | .... | .... | .... | .03 | .... | .... | .... | .... | .... | .... | .... |
| 16 | .42 | .44 | .02 | .... | .... | .02 | .... | .32 | .... | .12 | .10 | .... |
| 17 | .17 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .52 | .... |
| 18 | .14 | .... | .04 | .... | .13 | .12 | .01 | .... | .... | .20 | .... | .... |
| 19 | .... | .07 | .... | .76 | .01 | .... | .11 | .... | .... | .22 | .... | .... |
| 20 | .01 | .15 | .... | .01 | .90 | .... | .... | .... | .04 | .... | .... | .... |
| 21 | .44 | 1.10 | .15 | .... | .08 | .... | .... | .... | .72 | .... | .... | .... |
| 22 | .... | .01 | .08 | .... | .16 | .... | .... | .... | 3.02 | .... | .... | .45 |
| 23 | .... | .... | .... | .... | .70 | .... | .... | .07 | .30 | .... | .... | .05 |
| 24 | .... | .... | .... | .... | .... | .... | .... | .... | .03 | .01 | .... | .... |
| 25 | .55 | .... | .... | .... | .08 | .... | .... | .... | .04 | .... | .... | .... |
| 26 | .37 | .... | .03 | .01 | .... | .... | .... | .... | .... | .... | .21 | .02 |
| 27 | .... | .... | .06 | 1.07 | .02 | .... | .... | .... | .... | .... | .... | .... |
| 28 | .28 | .01 | .... | .... | .75 | .... | .01 | .... | .29 | .... | .... | .... |
| 29 | .... | .... | .... | .... | .... | .... | .... | .... | .05 | .04 | .47 | .... |
| 30 | .... | .... | .15 | .... | .... | .35 | .... | .... | .... | .... | .... | .... |
| 31 | 1.24 | .... | .... | .... | .02 | .... | .... | .03 | .... | .... | .... | .... |
|  | 5.30 | 4.05 | 2.45 | 2.01 | 5.12 | 1.14 | 1.79 | .69 | 8.51 | 2.03 | 1.46 | 1.84 |

# TABLE VI.

## SHOWING THE AMOUNT AND SIZE OF PIPE LAID DURING THE YEAR 1882.

| Streets where laid. | | | Size of pipe. | | | | |
|---|---|---|---|---|---|---|---|
| Street. | From. | To. | 12 | 16 | 8 | 6 | 4 |
| Munroe.... | Washington | Willow ... | | 209.0 | 27.0 | | |
| Central av.. | Oxford ... | Munroe.... | | | 201.0 | 6.0 | |
| Astor Hill av | Hollings'orth | Acorn .... | | | | 591.0 | |
| Locust ... | Chestnut. .. | | | | | 459.6 | |
| Lynnfield... | Boston .... | Pratt .... | | | | 975.9 | |
| Pratt .... | Lynnfield... | | | | | 479.0 | |
| Bacheller .. | Boston. .. | Auburn.... | | | | | 558.0 |
| Bailey .... | Pratt ... | | | | | | 253.0 |
| Auburn. ... | Lynnfield... | Bachelder . | | | | | 273.0 |
| Washington | Extension.. | Boston ... | 57.4 | C.I. 28.0<br>181.6 | | | |
| Boston ... | Washington | Cemetery .. | | 1,214.6 | | 100.0 | |
| Cemetery .. | Boston. ... | | | | C. Iron. | 100.0<br>1,359.0 | C. I'n<br>258.0 |
| Webster ... | Jackson ... | | | | | 213.6 | |
| Clinton ... | Oakwood av. | Birch .... | | | | | 550.0 |
| Western av. | Chatham .. | | | | | 236.5 | |
| Hollings'orth | Rockaway.. | Wilson ... | | | | 745.6 | |
| Wilson ... | Hollings'orth | | | | | 228.6 | |
| Buffum av.. | Bay View av. | Grover ... | | | | 745.11 | |
| Cleveland av. | Western av. | Maple .... | | | | | 393.0 |
| Cedar..... | Boston ... | Winter ... | | | | 804.0 | |
| Court .... | Cottage ... | Linden ... | | | | | 595.0 |
| Bulfinch ... | Boston ... | | | | | 805.0 | 38.0 |
| Raddins ct. . | Boston ... | Holyoke... | | | | 588.9 | |
| Holyoke... | Raddin's Ct. | | | | | 333.0 | |
| Jefferson .. | Extension .. | Duke .... | | | | 374.0 | |
| Lilly..... | Extension .. | Adams ... | | | | 508.0 | 21.0<br>C.I. 17.8 |
| Groveland.. | Empire ... | Brook..... | | | | | 685.1 |
| Brook .... | Groveland . | Timson ... | | | | | 186.6 |
| Camden... | Ida ..... | Cooper ... | | | | 1,213.6 | |
| Elizabeth .. | Cottage ... | Linden ... | | | | | 771.0 |
| Laurel ... | Boston ... | | | | | | 1,007.6 |
| Berkley ... | May ..... | Saugus R R R | | | | | 567.6 |
| Glenwood.. | Endicott ... | President... | | | | 870.3<br>C.I. 14.0 | |
| Brookline. | Chatham .. | Eastern Av. | | | | 1,980.0 | |
| Park Place. | Laighton .. | Henry Av... | | | | | 258.8 |
| Strawb'ry av. | Franklin .. | | | | | | 572.10 |
| Ida ...... | River .... | Camden.... | | | | 78.0 | |
| Essex..... | Extension . | Swamp. line. | | | | 71.0 | |
| Total ... | ......... | ......... | 57.4 | 1,633.0 | 228.0 | 13,883.7 | 7,005.3 |

## TABLE VI.—Continued.

| Name of Court. | Size of Pipes. | | | |
|---|---|---|---|---|
| | 2 | 1 1-2 | 1 1-4 | 1 |
| Mace Place, from Breed St....... | 239.11 | 32.8 | | |
| Shepard Place, from Shepard St.. | 146.6 | | | |
| Deer Grove, from Ocean St....... | 337.2 | 95.3 | | |
| Essex Place, from Essex St...... | | 125.8 | 69.0 | |
| Dennison Av., extension to Gage's Court .......................... | | 164.5 | | |
| Duke St., from Jefferson to Adams Street ......................... | 236.4 | | | |
| Prince Street, from Jefferson to Adams Street.................. | 236.0 | | | |
| Collins Ct., from Logan Street ... | 204,4 | | | |
| Fremont Ct., from Fremont St ... | 177.10 | | | |
| Orrin Ct., from Linden St........ | | | 160.8 | 44.2 |
| Railroad Ct., from South St. Ct. .. | | 207.6 | | |
| South-Street Ct.. extension....... | | 38.2 | | |
| Libby Ct. ........................ | | | | 72.8 |
| Total............................ | 1,578.1 | 663.8 | 229.8 | 116.10 |

| | | |
|---|---|---|
| Total extension in 1882............... | 4 miles, | 4,275.5 feet. |
| Previously laid........................ | 60 miles. | 1,930 feet. |
| Total pipe laid to January 1, 1883...... | 65 miles. | 925 feet. |
| Total pipe laid in Saugus.............. | 1 mile, | 530 feet. |
| Total pipe laid in Swampscott........ | | 1778 feet. |
| Total pipe laid in connection with the works............................ | 66 miles. | 3,233 feet. |

# TABLE VII.

## SHOWING THE LOCATION AND SIZE OF GATES SET IN 1882.

| Street. | Location. | Size. Inches. |
|---|---|---|
| Astor Hill Av.. | 10 feet W. from the E. line of Astor Hill Av.<br>6½ ft. S. from the S. line of Hollingsworth St. | 6 |
| Auburn ...... | 8 feet S. from the N. line of Auburn St.<br>2 feet E. from the E. line of Lynnfield St... | 4 |
| Boston ........ | 18 feet N. from the S. line of Boston St.<br>On the line of the E. line of Washington St. | 10 |
| Boston ........ | 11¾ feet S. from the N. line of Boston St.<br>13¾ ft. E. from W. side of E.Gate to Cemetery | 6 |
| Bacheller...... | 13 feet W. from the E. line of Bacheller St.<br>On the line of the N. line of Boston........ | 4 |
| Bailey......... | 17 feet W. from the E. line of Bailey St.<br>On the line of the S. line of Pratt St........ | 4 |
| Bulfinch ...... | 16½ feet W. from the E. line of Bulfinch St.<br>2 feet N. from the N. line of Boston St...... | 6 |
| Buffum Av..... | 16 feet S. from the N. line of Buffum Ave.<br>On the line of the W. line of Bay View Av. | 6 |
| Berkley ....... | 14 feet S. from the N. line of Berkley St.<br>1 foot E. from the E. line of May St....... | 4 |
| Brook ......... | 11 feet E. from the W. line of Brook St.<br>2 feet S. from the S. line of Timson St..... | 4 |
| Brookline ..... | 16 feet S. from the N. line of Brooklyn St.<br>3 feet E. from the E. line of Chatham St... | 6 |
| Brookline ..... | 18 feet S. from the N. line of Brookline St.<br>3 feet W. from the W. line of Empire St.... | 6 |
| Brookline...... | 18 feet S. from the N. line of Brookline St.<br>3 feet E. from the E. line of Empire St..... | 6 |
| Camden ....... | 17½ ft. S. from the N. line of Camden St.<br>4 feet W. from the W. line of Ida St....... | 6 |
| Central Av..... | 17¾ ft. E. from the W. line of Central Av.<br>On the line of the S. line of Oxford Sr..... | 8 |
| Cedar ......... | 14 feet E. from the W. line of Cedar St.<br>1 ft. N. from the N. line of Boston St....... | 6 |
| Cedar ......... | 17½ feet E. from the W. line of Cedar St.<br>On the line of the S. line of Walnut St..... | 6 |
| Clinton........ | 31 feet E. from the W. line of Clinton St.<br>On the line of the S. line of Oakwood Av.. | 4 |
| Cleveland Av .. | 22½ ft. W. from the E. line of Clveland Av.<br>2 feet S. from the S. line of Maple St...... | 4 |
| Cleveland Av... | 28 feet E. from the W. line of Cleveland Av.<br>2 feet N. from the N. line of Western Av.. | 4 |
| Court.......... | 8½ feet S. from the N. line of Court St.<br>ft. W. from the W. line of Cottage St...... | 4 |
| Court.......... | 8 feet S. from N. line of Court St.<br>2 feet E. from the E. line of Linden St.... | 4 |

# TABLE VII.—Continued.

## SHOWING THE LOCATION AND SIZE OF GATES SET IN 1882.

| Street. | Location. | Size. Inches. |
|---|---|---|
| Essex | 49 feet S. from the N. line of Essex St.<br>52½ ft. W. from the S.E. cor. of Essex and Cherry Sts | 6 |
| Elizabeth | 6 feet N. from the S. line of Elizabeth St.<br>2 feet E. from the E. line of Linden St | 4 |
| Elizabeth | 10 feet W. from the east line of Elizabeth St.<br>3 feet S. from the N. line of Court St | 4 |
| Elizabeth | 6½ feet S. from the N. line of Elizabeth St.<br>4 feet W. from the W. line of Cottage St | 4 |
| Hollingsworth | 17 feet N. from the S. line of Hollingsworth St.<br>On the line of the E. line of Rockaway St | 6 |
| Laurel | 18 feet W. from the E. line of Laurel St.<br>1 ft. S. from the S. line of Boston St | 4 |
| Locust | 16 feet N, from the S. line of Locust St.<br>On the line of the W. line of Chestnut St | 6 |
| Lynnfield | 15¾ ft. W. from the E. line of Lynnfield St.<br>23½ feet N. from the N. line of Boston St | 6 |
| Munroe | 25 feet N. from the S. line of Munroe St.<br>1 ft. W. from the E. line of Washington St | 10 |
| Park Place | 14 feet E. from the W. line of Park Place<br>1½ feet N. from the N. line of Henry Av | 4 |
| Pratt | 30 feet N. from the S. line of Pratt St.<br>1½ ft. W. from the W. line of Lynnfield St | 6 |
| Raddin's Ct | 16¼ feet E. from the W. line of Raddin's Ct.<br>On the line of the N. line of Boston St | 6 |
| Strawberry Av. | 16 ft. S. from the N. line of Strawberry Av.<br>3 feet W. from the W. line of Franklyn St | 4 |
| Waverly | 14 feet N. from the S. line of Waverly St.<br>2 ft. W. from the W. line of Bulfinch St | 4 |
| Western Av | 25½ ft. N. from the S. line of Western Av.<br>7 ft. E. from the E. line of Chatham St | 6 |
| Webster | 19 feet S. from the N. line of Webster St.<br>On the line of the E. line of Chatham St | 6 |
| Willlow | 4 feet E. from the W. line of Willow St.<br>17½ S. from the S. line of Dickson's building | 8 |
| Wilson | 15 feet W. from the E. line of Wilson St.<br>1 ft. N. from the N. line of Hol'worth St | 6 |
| Washington | 33 fl. W. from the E. line of Washington St<br>On the line of the S. line of Boston St | 10 |

## TABLE VII.—Continued.

### LOCATION AND SIZE OF GATES SET IN COURTS IN 1882.

| Court. | Location. | Size, Inches. |
|---|---|---|
| Collins | 7½ ft. W. from the E. line of Collins Ct. 2 ft. S. from the S. line of Logan St | 2 |
| Deer Cove | 12 ft. W. from the E. line of Deer Cove St. On the line of the S. line of Ocean St | 2 |
| Dennison Av. | 13½ ft. W. from the E. line of Dennison Av. On the line of the S. line of Gages Ct | 1¼ |
| Duke | 17 ft. E. from the W. line of Duke St. On the line of the S. line of Jefferson St. | 2 |
| Essex Place | 4 ft. W. from the E. line of Essex Place. 6 ft. S. from the N. line of Essex St | 1½ |
| Freemont | 14 ft. S from the N. line of Fremont Ct. 2½ ft. E. from the E. line of Fremont St | 2 |
| Mace Place | 14½ ft. S. from the N. line of Mace Place. On the line of the E. line of Breed St | 2 |
| Orrin | 8¼ ft S. from the N. line of Orrin Ct. On the line of the E. line of Linden St | 1½ |
| Prince | 13 ft. E. from the W. line of Prince St. On the line of the S. line of Jefferson St. | 2 |
| Shepard Place | 10 ft. S. from the N. line of Shepard Place. 6½ ft. W. from the E. line of Shepard St. | 2 |
| Cemetery Waste Gate | 13 ft. E. from the W. line of the Av. 3 ft. S. from the gate to the Lawn | 2 |
| Cemetery Waste Gate | At the catch basin junction of Poplar and Hemlock Avenues | 2 |
| Munroe St. Waste Gate | 23 ft N. from the S. line of Munroe St. 10½ feet E. from the W. line of Central Av. | 2 |

| | |
|---|---|
| Number of Gates set in 1882 | 54 |
| Number of Gates previously set | 447 |
| Total number of Gates set to January 1, 1883 | 501 |

# TABLE VIII.

## SHOWING THE NUMBER AND LOCATION OF HYDRANTS SET IN 1882.

| Street. | Location. |
|---|---|
| Astor Hill Av | 240 feet E. from Hollingsworth St. |
| Astor Hill Avenue | Corner Acorn St. |
| Bacheller | 45 feet N. from Auburn St. |
| Berkley | 30 feet N. from Saugus Branch R. R. |
| Boston | 270 feet E. from Washnigton St. |
| Boston | 75 feet E. from Grant St. |
| Boston | 390 feet E. from Grant St. |
| Boston | Opposite the E. entrance to Cemetery. |
| Buffum Avenue | Opposite Grover St. |
| Buffum Avenue | 20 feet W. from Bay View Ave. |
| Bulfinch | 360 feet N. from Waverly St. |
| Brookline | Corner of Brookline Court. |
| Brookline | 210 feet E. from Brook St. |
| Brookline | Corner of Empire St. |
| Brookline | 300 feet E. from Empire St. |
| Brookline | Corner of Eastern Ave. |
| Camden | 400 feet W. from Ida St. |
| Camden | 400 feet E. from Cooper St. |
| Camden | Corner of Cooper St. |
| Central Avenue | Corner of Munroe St. |
| Cedar | 410 feet N. from Boston St. |
| Clinton | 200 feet N. from Birch St. |
| Court | 250 feet W. from Cottage St. |
| Elizabeth | 170 feet W. from Cottage Street. |
| Glenwood | 70 feet W. from President St. |
| Glenwood | 475 feet W. from President St. |
| Groveland | Corner of Empire St. |
| Groveland | 185 feet E. from Brook St. |
| Hollingsworth | 305 feet E. from Rockaway St. |
| Hollingsworth | Corner of Wilson St. |
| Holyoke | 325 feet E. from Raddin's Court. |
| Jefferson | Corner of Duke St. |
| Laurel | 440 feet S. from Boston St. |
| Laurel | 900 feet S. from Boston St. |
| Lilly | Corner of Adams St. |
| Lilly | 350 feet S. from Adams St. |
| Locust | 420 feet W. from Chestnut St. |
| Lynnfield | Corner of Auburn St. |
| Lynnfield | 100 feet N. from Pratt St. |
| Munroe | 225 feet E. Market St. |
| Pine Grove Cemetery | Junction of Poplar and Locust Av. |
| Pratt | Corner of Bailey St. |
| Raddin's Court | 400 feet N. from Boston St. |
| Strawberry Avenue | 330 feet W. from Franklin St. |

| | |
|---|---|
| Number of Hydrants set in 1882 | 44 |
| Previously set | 454 |
| Number of Hydrants set to Jan. 1883 | 498 |

# TABLE IX.

## SHOWING THE NUMBER, SIZE, AND LENGTH OF SERVICES, PUT IN IN 1882.

| Month. | Size and Length of Pipe. | | | | | | | | | | Total. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 inch. | | 1 1-2 Inch. | | 1 1-4 Inch. | | 1 Inch. | | 3-4 inch. | | | |
| | No. | Length. | No. | Length. | No. | Length. | No. | Length. | No. | Length. | No. | Length. |
| January | | | | | | | 4 | 198.11 | 4 | 130.09 | 8 | 329.8 |
| February | | | | | | | | | | | | |
| March | | | | | | | 2 | 69.06 | 22 | 698.04 | 24 | 767.10 |
| April | | | | | | | 3 | 445.11 | 27 | 863.09 | 30 | 1,309.08 |
| May | | | | | | | 7 | 540.00 | 36 | 1,507.09 | 43 | 2,047.09 |
| June | | | | | 1 | 17.05 | 5 | 353.11 | 34 | 1,301.02 | 40 | 1,672.06 |
| July | 1 | 34.02 | | | | | 4 | 174.11 | 24 | 767.06 | 29 | 976.07 |
| August | | | 1 | 262.05 | 1 | 77.05 | 19 | 1,118.01 | 76 | 2,802.05 | 97 | 4,260.04 |
| September | | | | | | | 5 | 177.44 | 57 | 2,027.06 | 62 | 2,204.10 |
| October | | | | | 1 | 157.11 | 4 | 314.08 | 59 | 2,179.10 | 64 | 2,652.05 |
| November | | | | | 1 | 483.02 | 3 | 295.10 | 50 | 1,714.01 | 54 | 2,493.01 |
| December | | | | | 1 | 400.02 | 6 | 205.03 | 33 | 1,262.06 | 40 | 1,867.11 |
| Totals | 1 | 34.02 | 1 | 262.05 | 5 | 1,136.01 | 62 | 3,894.04 | 422 | 15,255.07 | 491 | 20,582.07 |

# TABLE X.

## REPAIRS OF PIPES, GATES AND HYDRANTS, DURING THE YEAR 1882.

| Month. | Size of Pipes. | | | | | | | | | | | Size of Gates. | | | | | | Hydrants. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 16 | 12 | 10 | 8 | 6 | 4 | 2 | 1½ | 1¼ | 1 | ¾ | 16 | 12 | 10 | 8 | 6 | 4 | |
| January | | 1 | | | 2 | 3 | | | | 1 | 1 | | | | | | | 4 |
| February | | | | | 3 | 1 | | | | | | | | | | | | 1 |
| March | 1 | | | | 6 | 1 | | | | 2 | 2 | | | | | | | |
| April | | | | 1 | 3 | 8 | | | | 1 | 1 | | | | | | | 3 |
| May | 1 | | | | 2 | 4 | | | | | 1 | | | | | | | 5 |
| June | | | 1 | 1 | 8 | 5 | | | | 1 | 1 | | | | | | | 3 |
| July | | | 2 | 3 | 11 | 7 | | | | | | | | | | | | 4 |
| August | | | | 1 | 5 | 2 | | | | | 1 | | | | | | | 3 |
| September | | | | | 6 | 6 | | 1 | | | | | | | | | | 2 |
| October | | | | 2 | 5 | 3 | | | | 1 | 1 | | | | | | | 8 |
| November | | | | 2 | 5 | 1 | | | | | | | | | | | | 2 |
| December | 1 | | 1 | | 1 | 3 | | 1 | | 1 | 1 | | | | | | | 1 |
| Totals | 3 | 1 | 4 | 10 | 57 | 44 | | 2 | | 7 | 9 | | | | | | | 36 |

## METEOROLOGICAL RECORD FOR JANUARY, 1882.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.71 | 26°.5 | 58 | 29.75 | 31°.5 | 74 | 29.79 | 28° | 59 | 33° | 12° | 21° | 22°.5 | .29 |
| 2 | 29.65 | 13 | 62 | 29.69 | 15.5 | 48 | 29.73 | 15 | 47 | 18 | 5 | 13 | 11.5 | .00 |
| 3 | 29.88 | 7 | 54 | 29.92 | 20.5 | 35 | 29.96 | 22 | 52 | 26.5 | 4 | 22.5 | 15.2 | .00 |
| 4 | 30.04 | 4 | 33 | 30.13 | 12 | 33 | 30.30 | 11 | 52 | 16.5 | 2 | 14.5 | 9.2 | .00 |
| 5 | 30.52 | 3.5 | 63 | 30.57 | 19 | 54 | 30.61 | 19.5 | 62 | 23 | 3.5 | 19.5 | 13.2 | .00 |
| 6 | 30.60 | 22 | 65 | 30.53 | 28 | 88 | 30.41 | 33 | 89 | 40 | 22.5 | 17.5 | 31.2 | .26 |
| 7 | 30.01 | 33 | 79 | 30.02 | 39 | 64 | 30.08 | 35.5 | 67 | 41 | 26 | 15 | 33.5 | .00 |
| 8 | 30.20 | 24.5 | 80 | 30.20 | 35.5 | 71 | 30.17 | 37 | 67 | 47 | 29.5 | 17.5 | 38.2 | .03 |
| 9 | 29.85 | 47 | 85 | 29.83 | 44.5 | 52 | 29.89 | 40 | 64 | 48.5 | 32 | 16.5 | 40.2 | .00 |
| 10 | 30.14 | 32 | 84 | 30.21 | 36.5 | 50 | 29.25 | 33.5 | 51 | 38 | 26.5 | 11.5 | 32.2 | .18 |
| 11 | 30.22 | 32 | 89 | 30.02 | 34 | 100 | 29.92 | 35 | 80 | 42 | 30 | 12 | 36 | .18 |
| 12 | 30.05 | 33 | 79 | 30.19 | 35 | 44 | 30.29 | 30 | 56 | 38 | 22.5 | 15.5 | 30.2 | .00 |
| 13 | 30.39 | 25.5 | 69 | 30.20 | 33 | 95 | 29.85 | 36 | 95 | 39 | 25.5 | 13.5 | 32.2 | .18 |
| 14 | 29.53 | 38 | 64 | 29.60 | 31.5 | 58 | 29.73 | 27 | 41 | 41 | 19 | 22 | 30 | .01 |
| 15 | 29.93 | 22 | 72 | 29.93 | 33.5 | 57 | 30.94 | 32 | 64 | 38 | 23.5 | 14.5 | 30.7 | .01 |
| 16 | 29.83 | 37.5 | 81 | 29.77 | 43.5 | 78 | 29.79 | 41.5 | 57 | 46.5 | 21 | 25.5 | 33.7 | .30 |
| 17 | 29.88 | 21 | 85 | 29.99 | 21 | 57 | 30.12 | 17.5 | 51 | 23 | 1.5 | 21.5 | 12.2 | .05 |
| 18 | 30.34 | 1.5 | 86 | 30.44 | 23 | 60 | 30.40 | 28.5 | 83 | 39 | 3.5 | 35.5 | 21.2 | .13 |
| 19 | 30.11 | 30 | 78 | 30.10 | 36 | 59 | 30.15 | 31 | 63 | 37.5 | 15 | 22.5 | 26.2 | .00 |
| 20 | 30.28 | 16.5 | 67 | 30.32 | 30.5 | 67 | 30.32 | 29 | 88 | 35 | 17 | 18 | 26 | .01 |
| 21 | 30.25 | 31 | 84 | 30.18 | 37.5 | 72 | 30.06 | 35 | 90 | 40 | 32.5 | 7.5 | 36.2 | .14 |
| 22 | 29.68 | 36 | 81 | 29.65 | 37.5 | 59 | 29.68 | 21 | 29 | 40 | 2.5 | 37.5 | 21.2 | .00 |
| 23 | 29.78 | 3 | 60 | 29.84 | 5.5 | 68 | 29.95 | 2.5 | 31 | 8 | -12 | 20 | -2 | .00 |
| 24 | 30.35 | -11 | 54 | 30.47 | 2.5 | 59 | 30.60 | 4 | 35 | 9 | -10 | 19 | -0.5 | .00 |
| 25 | 30.73 | 7 | 65 | 30.70 | 27 | 52 | 30.64 | 28 | 77 | 41 | 7 | 34 | 24 | .47 |
| 26 | 30.06 | 40.5 | 95 | 30.01 | 42.5 | 83 | 29.96 | 41 | 83 | 48 | 40 | 8 | 44 | .31 |
| 27 | 29.53 | 48 | 74 | 29.70 | 43 | 51 | 29.95 | 39.5 | 56 | 48 | 24.5 | 23.5 | 36.2 | .00 |
| 28 | 30.28 | 25 | 68 | 30.26 | 34 | 70 | 30·10 | 33.5 | 90 | 38 | 27 | 11 | 32.5 | .23 |
| 29 | 29.75 | 32 | 69 | 29.75 | 24.5 | 43 | 29.78 | 17.5 | 41 | 32.5 | 14 | 18.5 | 23.2 | .00 |
| 30 | 30.04 | 18.5 | 61 | 30.04 | 26.5 | 70 | 30.04 | 27 | 76 | 31 | 19 | 12 | 25 | .00 |
| 31 | 30.03 | 20 | 63 | 29.99 | 32 | 79 | 29.86 | 27.5 | 100 | 34 | 22.5 | 11.5 | 28.2 | 1.68 |

Monthly range.............................. ..60°.05
Monthly mean.............................. 25°.62
Monthly rainfall.............................. 4.76

## METEOROLOGICAL RECORD FOR FEBRUARY, 1882.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.67 | 27° | 87 | 29.80 | 33°.5 | 70 | 29.92 | 31° | 73 | 36°.5 | 26° | 10°.5 | 31°.2 | .00 |
| 2 | 29.97 | 26.5 | 71 | 29.99 | 38.5 | 64 | 29.98 | 35.5 | 58 | 39.5 | 27.5 | 12 | 33.5 | .07 |
| 3 | 29.84 | 32 | 75 | 29.84 | 35 | 62 | 29.92 | 25.5 | 63 | 38 | 4 | 34 | 21 | .00 |
| 4 | 30 03 | 5.5 | 63 | 30.06 | 16.5 | 66 | 30.02 | 22 | 94 | 22.5 | 6.5 | 16 | 14.5 | 1.00 |
| 5 | 29.64 | 10.5 | 80 | 29.59 | 21.5 | 65 | 29.62 | 20.5 | 64 | 24 | 11 | 13 | 17.5 | .14 |
| 6 | 29 85 | 13 | 62 | 29.98 | 26 | 40 | 30.08 | 22 | 51 | 27.5 | 14 | 13.5 | 20.7 | .00 |
| 7 | 30.25 | 21 | 64 | 30.31 | 26 | 69 | 30.29 | 30 | 67 | 37.5 | 21.5 | 16 | 29.5 | .09 |
| 8 | 29.92 | 34 | 80 | 29.94 | 41 | 49 | 30.03 | 36 | 54 | 42 | 19.5 | 22.5 | 30.7 | .00 |
| 9 | 30.13 | 22.5 | 80 | 30.09 | 36.5 | 63 | 29.98 | 33 | 84 | 39 | 25 | 14 | 32 | .75 |
| 10 | 29.64 | 31.5 | 95 | 29.60 | 37.5 | 68 | 29.69 | 32 | 59 | 38.5 | 21 | 17.5 | 29.7 | .04 |
| 11 | 30.15 | 21 | 50 | 30.44 | 28 | 54 | 30.52 | 27·5 | 53 | 31 | 21 | 10 | 26 | .00 |
| 12 | 30.55 | 29 | 66 | 30.53 | 42 | 62 | 30.48 | 38.5 | 72 | 42.5 | 31 | 11.5 | 36.7 | .00 |
| 13 | 30.28 | 40.5 | 90 | 30.16 | 44.5 | 88 | 30.01 | 46.5 | 92 | 48 | 39.5 | 8.5 | 43.7 | .01 |
| 14 | 30.03 | 39.5 | 64 | 30.07 | 45 | 49 | 30.12 | 41.5 | 45 | 46 | 30 | 16 | 38 | .00 |
| 15 | 30.15 | 31 | 78 | 30.18 | 45 | 57 | 30 18 | 43 | 67 | 49 | 35.5 | 13.5 | 42.2 | .00 |
| 16 | 30.25 | 35.5 | 85 | 30.25 | 47.5 | 70 | 30.20 | 44.5 | 68 | 50 | 36.5 | 13.5 | 43.2 | .41 |
| 17 | 29.81 | 42 | 91 | 29.87 | 45 | 45 | 30.10 | 29 | 50 | 47.5 | 8.5 | 39 | 28 | .00 |
| 18 | 30.42 | 8.5 | 56 | 30.58 | 16.5 | 34 | 30.64 | 18.5 | 38 | 21 | 10.5 | 10.5 | 15.7 | .00 |
| 19 | 30.67 | 16 | 49 | 30.65 | 22.5 | 66 | 30.62 | 24.5 | 74 | 32.5 | 18.5 | 14 | 25.5 | .03 |
| 20 | 30.44 | 29.5 | 88 | 30.19 | 37.5 | 68 | 30.16 | 33.5 | 70 | 38 | 29.5 | 8.5 | 33.7 | .14 |
| 21 | 30.17 | 30.5 | 95 | 30.08 | 30.5 | 100 | 29.93 | 28.5 | 100 | 30.5 | 19.5 | 11 | 25 | .84 |
| 22 | 29.60 | 20.5 | 85 | 28.65 | 26 | 63 | 29.71 | 23.5 | 73 | 25 | 15 | 10 | 20 | .00 |
| 23 | 29.84 | 16 | 66 | 29.88 | 26 | 69 | 29.81 | 25.5 | 62 | 29.5 | 17 | 12.5 | 23.2 | .00 |
| 24 | 29.97 | 18 | 60 | 30.09 | 29 | 77 | 30.14 | 30 | 62 | 33 | 17 | 16 | 25 | .00 |
| 25 | 30.27 | 19 | 77 | 30.33 | 33 | 70 | 30.34 | 32 | 75 | 36.5 | 19 | 17.5 | 27.7 | .00 |
| 26 | 30.35 | 22 | 66 | 30 34 | 37 | 63 | 30.32 | 37.5 | 68 | 42.5 | 22 | 20.5 | 32.2 | .00 |
| 27 | 30.25 | 34 | 75 | 30.24 | 46.5 | 54 | 30.26 | 41.5 | 57 | 48 | 32 | 16 | 40 | .00 |
| 28 | 30.39 | 32 | 84 | 30.44 | 39 | 73 | 30.45 | 36.5 | 71 | 39.5 | 32 | 7.5 | 35.7 | .02 |

| | |
|---|---|
| Monthly range | 46° |
| Monthly mean | 29°.37 |
| Monthly rainfall | 3.54 |

## METEOROLOGICAL RECORD FOR MARCH, 1882.

| Date. | 8. A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.30 | 38°.5 | 91 | 30.17 | 43° | 92 | 30.05 | 41°.5 | 95 | 49° | 36°.5 | 12°.5 | 42°.7 | 1.01 |
| 2 | 29.87 | 44.5 | 96 | 30.88 | 46.5 | 92 | 29.90 | 46 | 80 | 47.5 | 36.5 | 11 | 42 | .27 |
| 3 | 29.89 | 39.5 | 82 | 29.83 | 43.5 | 68 | 29.77 | 41.5 | 66 | 45.5 | 36.5 | 9 | 41 | .00 |
| 4 | 29.69 | 36.5 | 54 | 29.67 | 37.5 | 59 | 29.71 | 37.5 | 59 | 39 | 33.5 | 5.5 | 36.2 | .00 |
| 5 | 29.97 | 36.5 | 59 | 30.09 | 41.5 | 62 | 30.12 | 36.5 | 67 | 43.5 | 37 | 6.5 | 40.2 | .00 |
| 6 | 30.00 | 40 | 91 | 29.92 | 44 | 79 | 29.85 | 42 | 91 | 46 | 36.5 | 9.5 | 41.2 | .09 |
| 7 | 29.93 | 38.5 | 86 | 30.06 | 37.5 | 59 | 30.17 | 30.5 | 56 | 38.5 | 20 | 18.5 | 29.2 | .00 |
| 8 | 30.39 | 21 | 42 | 30.50 | 30 | 67 | 29.56 | 30.5 | 52 | 32 | 22 | 10 | 27 | .00 |
| 9 | 30.57 | 28.5 | 77 | 30.50 | 38.5 | 64 | 30.32 | 33 | 95 | 40.5 | 30 | 10.5 | 35.2 | .53 |
| 10 | 29.73 | 34 | 95 | 29.65 | 42 | 83 | 29.68 | 41 | 57 | 49.5 | 29.5 | 20 | 39.5 | .01 |
| 11 | 29.94 | 31 | 73 | 30.04 | 38 | 55 | 30.07 | 37 | 47 | 40.5 | 32.5 | 8 | 36.5 | .00 |
| 12 | 30.12 | 35.5 | 76 | 30.05 | 39.5 | 73 | 29.84 | 40 | 73 | 43.5 | 36.5 | 7 | 40 | .06 |
| 13 | 29.63 | 36.5 | 67 | 29.57 | 41 | 66 | 29.55 | 33.5 | 66 | 41.5 | 20.5 | 21 | 31 | .00 |
| 14 | 29.63 | 21 | 42 | 29.79 | 28 | 65 | 29.90 | 24 | 54 | 28 | 16 | 12 | 22 | .00 |
| 15 | 30.14 | 20 | 54 | 30.22 | 30 | 52 | 30.26 | 29 | 72 | 32 | 20 | 12 | 26 | .00 |
| 16 | 30.28 | 32 | 75 | 30.29 | 33 | 70 | 30.28 | 31.5 | 89 | 34.5 | 28 | 6.5 | 31.2 | .02 |
| 17 | 30.30 | 28.5 | 83 | 30.34 | 32 | 69 | 30.36 | 32.5 | 75 | 34.5 | 24 | 10.5 | 29.2 | .00 |
| 18 | 30.40 | 24.5 | 74 | 30.40 | 26:5 | 82 | 30.37 | 30 | 78 | 32.5 | 25 | 7.5 | 28.7 | .03 |
| 19 | 30.19 | 32 | 79 | 30.12 | 43 | 67 | 30.07 | 45.5 | 65 | 49 | 36 | 13 | 42.5 | .00 |
| 20 | 30.06 | 38.5 | 60 | 30.04 | 54 | 43 | 30.01 | 51 | 40 | 56 | 36 | 20 | 46 | .00 |
| 21 | 29.98 | 36 | 63 | 29.95 | 34.5 | 66 | 29.88 | 32 | 84 | 37 | 27 | 10 | 32 | .14 |
| 22 | 29.87 | 29 | 83 | 29.93 | 37 | 72 | 29.94 | 32 | 84 | 40 | 25 | 15 | 32.5 | .08 |
| 23 | 30.14 | 27 | 76 | 30.21 | 37 | 51 | 30.23 | 33 | 70 | 39.5 | 29 | 10.5 | 34.2 | .00 |
| 24 | 30.05 | 39.5 | 73 | 29.96 | 35.5 | 58 | 29.97 | 33 | 42 | 43.5 | 16.5 | 27 | 30 | .00 |
| 25 | 30.12 | 17.5 | 36 | 30.15 | 25.5 | 45 | 30.18 | 27 | 52 | 29 | 19.5 | 9.5 | 24.2 | .00 |
| 26 | 30.24 | 25.5 | 56 | 30.25 | 33.5 | 57 | 30 24 | 34 | 76 | 41.5 | 27.5 | 14 | 34.5 | .01 |
| 27 | 30.10 | 41 5 | 87 | 29.98 | 50 | 82 | 29.77 | 48.5 | 88 | 53.5 | 43 | 10.5 | 48.2 | .04 |
| 28 | 29.53 | 47.5 | 66 | 29.65 | 42 | 58 | 27.78 | 39.5 | 48 | 47.5 | 25 | 22.5 | 36.2 | .00 |
| 29 | 30.06 | 30.5 | 73 | 30.18 | 35.5 | 67 | 30.21 | 35 | 67 | 38.5 | 30.5 | 8 | 34 5 | .00 |
| 30 | 30.09 | 38.5 | 76 | 29.97 | 45.5 | 80 | 29.98 | 43 | 43 | 49.5 | 25.5 | 24 | 37.5 | .06 |
| 31 | 30.10 | 26 | 40 | 30.22 | 30 | 56 | 30.28 | 29 | 45 | 32.5 | 20 | 12.5 | 26.2 | .00 |

Monthly range.................................40°
Monthly mean................................ 34°.77
Monthly rainfall................................ 2.35

## METEOROLOGICAL RECORD FOR APRIL, 1882.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.01 | 30°.5 | 46 | 30.40 | 38°.5 | 64 | 30.35 | 38° | 64 | 45° | 32°.5 | 12°.5 | 38°.7 | .01 |
| 2 | 30.44 | 44.5 | 68 | 29.88 | 63 | 64 | 29.83 | 60.5 | 50 | 66 | 31 | 35 | 48 5 | .00 |
| 3 | 30.32 | 34 | 66 | 30.48 | 32.5 | 70 | 30.49 | 32 | 79 | 35.5 | 32 | 3.5 | 33.7 | .00 |
| 4 | 30.45 | 35.5 | 71 | 30.26 | 52.5 | 56 | 30.10 | 54 | 64 | 57.5 | 38 | 19.5 | 47.7 | .06 |
| 5 | 30.22 | 38 | 59 | 30.32 | 38 | 55 | 30.39 | 35.5 | 58 | 39.5 | 28.5 | 11 | 34 | .00 |
| 6 | 30.49 | 34 | 70 | 30.54 | 37 | 51 | 30.54 | 34.5 | 71 | 40 | 35 | 5 | 37.5 | .04 |
| 7 | 30.39 | 35 | 80 | 30.20 | 38·5 | 91 | 30.06 | 41 | 91 | 40.5 | 36.5 | 4 | 38.5 | .00 |
| 8 | 30.11 | 45 | 64 | 30.14 | 45 | 60 | 30.14 | 42 | 66 | 50.5 | 35 | 15.5 | 42.7 | .00 |
| 9 | 30.08 | 40 | 60 | 30.02 | 41.5 | 66 | 29.90 | 39.5 | 77 | 43 | 29 | 14 | 36 | .01 |
| 10 | 29.83 | 29 | 72 | 29.84 | 32.5 | 58 | 29.84 | 33 | 75 | 35 | 28.5 | 6.5 | 31.7 | .00 |
| 11 | 29.83 | 33 | 55 | 28.83 | 37 | 59 | 29.83 | 37 | 67 | 40 | 27 | 13 | 33.5 | .00 |
| 12 | 29.83 | 29 | 45 | 29.83 | 37.5 | 36 | 29.82 | 37.5 | 51 | 40.5 | 30.5 | 10 | 35.5 | .00 |
| 13 | 29.80 | 41 | 52 | 29.78 | 47 | 41 | 29.72 | 45 | 42 | 48.5 | 38.5 | 10 | 43.5 | .00 |
| 14 | 29.85 | 39 | 56 | 29.90 | 48 | 45 | 29.91 | 43 | 58 | 51.5 | 35.5 | 16 | 43.5 | .00 |
| 15 | 29.98 | 37.5 | 55 | 29.99 | 43.5 | 55 | 29.98 | 42 | 58 | 45 | 35.5 | 9.5 | 40.2 | .00 |
| 16 | 29.98 | 43.5 | 40 | 29.98 | 49 | 34 | 29.95 | 54 | 20 | 56 | 40.5 | 15.5 | 48.2 | .00 |
| 17 | 29.96 | 41.5 | 66 | 29.95 | 60.5 | 62 | 29.92 | 60.5 | 62 | 62.5 | 44 | 18.5 | 53.2 | .00 |
| 18 | 29.99 | 45 | 53 | 29.99 | 45 | 64 | 30.00 | 41.5 | 70 | 49 | 36.5 | 12.5 | 42.7 | .00 |
| 19 | 30.01 | 42.5 | 75 | 29.97 | 43.5 | 78 | 29.78 | 45 | 60 | 51.5 | 41 | 10.5 | 46.2 | .71 |
| 20 | 29.38 | 43.5 | 92 | 29.35 | 57.5 | 75 | 29.35 | 56 | 32 | 62 | 44 | 18 | 53 | .00 |
| 21 | 29.42 | 43.5 | 63 | 26.43 | 49 | 47 | 29.49 | 46 | 54 | 51 | 37.5 | 13.5 | 44.2 | .00 |
| 22 | 29.71 | 43 | 51 | 29.78 | 44.5 | 45 | 29.79 | 42 | 45 | 46.5 | 33 | 13.5 | 39.7 | .00 |
| 23 | 29.82 | 35 | 40 | 29.80 | 43 | 36 | 29.81 | 37 | 59 | 44 | 28 | 16 | 36 | .00 |
| 24 | 29.86 | 35 | 62 | 29.94 | 44 | 44 | 29.99 | 40 | 38 | 45 | 31 | 14 | 38 | .00 |
| 25 | 30.12 | 38.5 | 48 | 30.16 | 45 | 45 | 30.16 | 44 | 52 | 48 | 35 | 13 | 41.5 | .00 |
| 26 | 30.19 | 42 | 66 | 30.19 | 47.5 | 55 | 30.29 | 45.5 | 54 | 53.5 | 40 | 13.5 | 46.7 | .01 |
| 27 | 30.19 | 40 | 86 | 30.14 | 37 | 95 | 30.05 | 36 | 95 | 40 | 34 | 6 | 37 | .93 |
| 28 | 29 99 | 36.5 | 85 | 30.04 | 42 | 66 | 30.04 | 39.5 | 77 | 47.5 | 37.5 | 10 | 42 | .00 |
| 29 | 30.02 | 47.5 | 81 | 30.03 | 57.5 | 50 | 30.03 | 54 | 61 | 59 | 42.5 | 16.5 | 50.7 | .00 |
| 30 | 30.02 | 44.5 | 76 | 29.98 | 48 | 74 | 29.95 | 46 | 76 | 51 | 39 | 12 | 45 | .00 |

Monthly range..............................39°
Monthly mean.............................. 41°.66
Monthly rainfall.............................. 1.77

## METEOROLOGICAL RECORD FOR MAY, 1882.

| Date. | 8. A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.01 | 47° | 55 | 30.02 | 59° | 32 | 30.01 | 59° | 35 | 60°.5 | 43° | 17°.5 | 51°.7 | .00 |
| 2 | 29.97 | 52 | 70 | 29.91 | 46.5 | 61 | 29.95 | 43 | 34 | 60.5 | 33 | 27.5 | 46.7 | .02 |
| 3 | 30.13 | 40 | 49 | 30.14 | 49.5 | 29 | 30.08 | 54 | 25 | 55 | 40 | 15 | 47.5 | .00 |
| 4 | 29.96 | 53 | 49 | 29.86 | 66.5 | 50 | 29.78 | 61 | 47 | 67.5 | 41 | 26.5 | 54.2 | .00 |
| 5 | 29.87 | 44 | 55 | 29.90 | 41 | 70 | 29.91 | 43.5 | 71 | 45 | 34.5 | 10.5 | 39.7 | .00 |
| 6 | 30.05 | 44 | 44 | 30.09 | 45.5 | 42 | 30.12 | 47 | 66 | 47.5 | 38 | 9.5 | 42.7 | .00 |
| 7 | 30.25 | 46.5 | 37 | 30.31 | 46 | 47 | 30.34 | 45 | 57 | 48.5 | 37.5 | 11 | 43 | .00 |
| 8 | 30.38 | 48.5 | 67 | 30.36 | 63 | 42 | 30.27 | 50 | 68 | 64 | 48.5 | 15.5 | 56.2 | .43 |
| 9 | 29.88 | 51 | 86 | 29.82 | 65.5 | 54 | 29.80 | 68.5 | 30 | 70 | 45 | 25 | 57.5 | .00 |
| 10 | 29.94 | 51.5 | 50 | 29.95 | 49 | 57 | 29.96 | 48 | 67 | 52.5 | 40 | 12.5 | 46.2 | .00 |
| 11 | 30.09 | 38.5 | 82 | 30.14 | 41.5 | 70 | 30.17 | 41 | 66 | 42 | 39.5 | 2.5 | 40.7 | .05 |
| 12 | 30.20 | 40 | 73 | 30.20 | 40 | 73 | 30.17 | 40 | 82 | 41 | 39.5 | 1.5 | 40.2 | .25 |
| 13 | 30.05 | 41 | 95 | 29.99 | 42 | 100 | 29.93 | 41.5 | 91 | 44 | 41.5 | 2.5 | 42.7 | .21 |
| 14 | 29.75 | 44 | 87 | 29.70 | 46.5 | 76 | 29.63 | 44.5 | 88 | 45.5 | 38.5 | 7 | 42 | 1.06 |
| 15 | 29.62 | 38.5 | 100 | 29.74 | 39.5 | 77 | 29.90 | 40.5 | 77 | 42.5 | 35.5 | 7 | 39 | .06 |
| 16 | 30.07 | 42.5 | 62 | 30.07 | 45 | 79 | 30.05 | 45.5 | 72 | 49 | 40 | 9 | 44.5 | .00 |
| 17 | 30.05 | 45.5 | 69 | 30.17 | 48 | 29 | 30.22 | 46 | 47 | 48.5 | 42 | 6.5 | 45.2 | .01 |
| 18 | 30.29 | 42 | 78 | 30.45 | 43.5 | 43 | 30.47 | 39 | 77 | 45 | 38.5 | 6.5 | 41.7 | .07 |
| 19 | 30.41 | 39 | 91 | 30.38 | 43.5 | 75 | 30.33 | 43 | 75 | 47 | 40 | 7 | 43.5 | .02 |
| 20 | 30.13 | 47 | 77 | 30.03 | 50 | 86 | 29.94 | 50 | 89 | 52.5 | 47.5 | 5 | 50 | .85 |
| 21 | 29.89 | 49.5 | 86 | 29.90 | 56.5 | 82 | 29.91 | 59.5 | 57 | 59.5 | 46 | 13.5 | 52.7 | .07 |
| 22 | 30.08 | 54 | 77 | 30.16 | 58 | 66 | 30.19 | 47 | 85 | 58 | 43 | 15 | 50.5 | .13 |
| 23 | 30.14 | 43 | 100 | 30.06 | 43 | 96 | 30.07 | 43.5 | 84 | 45 | 37 | 8 | 41 | .72 |
| 24 | 30.11 | 45 | 84 | 30.11 | 58.5 | 88 | 30.11 | 59 | 35 | 61 | 46 | 15 | 53.5 | .00 |
| 25 | 30.13 | 58 | 53 | 30.13 | 58 | 53 | 30.13 | 50.5 | 78 | 59 | 41 | 18 | 50 | .06 |
| 26 | 30.15 | 51.5 | 79 | 30.15 | 53 | 66 | 30.11 | 58 | 64 | 59.5 | 45.5 | 14 | 52.5 | .00 |
| 27 | 30.10 | 53.5 | 74 | 30.07 | 67 | 59 | 30.03 | 63.5 | 59 | 67.5 | 55 | 12.5 | 61.2 | .02 |
| 28 | 29.88 | 59 | 82 | 29.82 | 72 | 71 | 29.74 | 68 | 76 | 72 | 56.5 | 15.5 | 64.2 | .66 |
| 29 | 29.63 | 56.5 | 90 | 29.72 | 66 | 45 | 29.78 | 63.5 | 35 | 65.5 | 46.5 | 19 | 56 | .02 |
| 30 | 29.96 | 57 | 49 | 29.95 | 67 | 33 | 29.90 | 70.5 | 34 | 70 | 50.5 | 19.5 | 60.2 | .00 |
| 31 | 29.91 | 61 | 68 | 59.87 | 71.5 | 60 | 29.82 | 68.5 | 67 | 73 | 58 | 15 | 65.5 | .01 |

| | | | |
|---|---|---|---|
| Monthly range | 40° | | |
| Monthly mean | | 49°.13 | |
| Monthly rainfall | | | 4.72 |

## METEOROLOGICAL RECORD FOR JUNE, 1882.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.65 | 59° | 94 | 29.54 | 63° | 94 | 29.56 | 65° | 86 | 65°.5 | 47° | 18°.5 | 56°.2 | .06 |
| 2 | 29.86 | 56.5 | 43 | 29.88 | 66 | 41 | 29.89 | 70 | 32 | 70 | 54 | 16 | 62 | .00 |
| 3 | 29.95 | 61 | 61 | 29.97 | 72 | 49 | 29.98 | 63 | 61 | 72.5 | 52 | 20.5 | 62.2 | .00 |
| 4 | 29.82 | 54.5 | 87 | 29.73 | 59 | 91 | 29.68 | 60.5 | 85 | 63 | 49 5 | 13.5 | 56.2 | .23 |
| 5 | 29.73 | 58.5 | 64 | 29 70 | 67.5 | 55 | 29.69 | 65.5 | 49 | 62.5 | 53 | 9.5 | 57.7 | .01 |
| 6 | 29.81 | 56.5 | 75 | 29 84 | 54 | 80 | 29 84 | 56 5 | 69 | 63 | 52 | 11 | 57.5 | .00 |
| 7 | 29.86 | 63 | 57 | 29.83 | 75 | 36 | 29 79 | 76 | 44 | 77 | 60.5 | 16.5 | 68.7 | .00 |
| 8 | 29.82 | 72 | 58 | 29.77 | 80 | 33 | 29.75 | 75 | 56 | 83 | 58.5 | 24.5 | 70.7 | .00 |
| 9 | 29.74 | 67.5 | 64 | 29.69 | 75 | 56 | 29.69 | 79 | 36 | 79 | 52 | 27 | 65.5 | .00 |
| 10 | 29.92 | 59 | 71 | 29.91 | 64.5 | 51 | 29.87 | 56 | 75 | 67 | 52 | 15 | 59.5 | .26 |
| 11 | 29.97 | 52.5 | 86 | 30.01 | 61.5 | 63 | 30.02 | 52 | 86 | 59.5 | 49.5 | 10 | 54.5 | .01 |
| 12 | 30.19 | 55 5 | 50 | 30.23 | 58 | 42 | 30.23 | 57.5 | 47 | 63 | 47 | 16 | 55 | .00 |
| 13 | 30.66 | 62 | 51 | 30.27 | 62 5 | 44 | 30.23 | 63 | 55 | 66.5 | 56 | 10.5 | 61.2 | .00 |
| 14 | 30.19 | 61 5 | 68 | 30.15 | 70.5 | 59 | 30 08 | 70.5 | 57 | 74 | 56.5 | 17.5 | 65.2 | .00 |
| 15 | 29.95 | 62.5 | 59 | 29.87 | 73.5 | 45 | 30.79 | 70 | 52 | 74 | 61 | 13 | 67.5 | .00 |
| 16 | 29.69 | 70 | 75 | 29.69 | 83 | 44 | 29.69 | 73.5 | 65 | 83 | 62.5 | 20.5 | 72.7 | .04 |
| 17 | 29.81 | 68 | 60 | 29.83 | 64 | 73 | 29.80 | 60 | 82 | 67.5 | 58.5 | 9 | 63 | .00 |
| 18 | 29.80 | 62.5 | 94 | 29.79 | 63.5 | 94 | 29.75 | 61 5 | 91 | 63 | 58 | 5 | 60.5 | .03 |
| 19 | 29.76 | 60 | 97 | 29.73 | 77.5 | 67 | 29.76 | 69 | 82 | 80 | 57 5 | 22.5 | 68.7 | .00 |
| 20 | 29.85 | 59 | 65 | 29.90 | 67 | 31 | 29.94 | 69 | 33 | 69.5 | 54 | 15.5 | 61.7 | .00 |
| 21 | 30.11 | 64.5 | 55 | 30.08 | 73.5 | 32 | 30 05 | 74 | 41 | 75 | 57.5 | 17.5 | 66.2 | .00 |
| 22 | 30.15 | 66 | 54 | 30 14 | 76 | 32 | 30.12 | 79 | 35 | 79 | 58 | 21 | 68.5 | .00 |
| 23 | 30 17 | 70 5 | 52 | 30.16 | 71 | 40 | 30.09 | 72 | 67 | 79 | 68 | 11 | 73.5 | .00 |
| 24 | 30 05 | 76 | 73 | 30 02 | 85 5 | 54 | 29.96 | 80.5 | 64 | 86 | 69.5 | 16.5 | 77.7 | .00 |
| 25 | 29.83 | 76 | 83 | 29.75 | 86.5 | 59 | 29.70 | 87.5 | 50 | 88.5 | 70.5 | 18 | 79.5 | .00 |
| 26 | 29.80 | 74.5 | 51 | 29.79 | 82 | 42 | 29.71 | 83.5 | 45 | 84 | 63 | 21 | 73.5 | .00 |
| 27 | 29 89 | 69.5 | 56 | 29.89 | 76.5 | 45 | 29.89 | 76 | 49 | 76.5 | 61 | 15.5 | 68.7 | .00 |
| 28 | 29.91 | 72 | 56 | 29 87 | 80 | 44 | 29.83 | 74.5 | 61 | 80.5 | 60 | 20.5 | 70.2 | .00 |
| 29 | 29.85 | 66 | 59 | 29.85 | 71.5 | 37 | 29.86 | 71 | 28 | 73 | 51.5 | 21.5 | 62.2 | .00 |
| 30 | 29.96 | 60 | 60 | 29 97 | 69.5 | 42 | 29.98 | 67 | 60 | 70 | 55 | 15 | 62.5 | .29 |

| | |
|---|---|
| Monthly range | 41°.5 |
| Monthly mean | 64°.98 |
| Monthly Rainfall | .93 |

## METEOROLOGICAL RECORD FOR JULY, 1882.

| Date. | 8 A. M. |  |  | 1 P. M. |  |  | 6 P. M. |  |  | 24 hours ending 8 A. M. |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 29.88 | 55° | 87 | 29.79 | 56° | 93 | 29.68 | 57° | 93 | 59°.5 | 53° | 6°.5 | 56° 2 | .45 |
| 2 | 29.66 | 59 | 84 | 29.66 | 70 | 54 | 29.71 | 70 | 42 | 70 | 53.5 | 16.5 | 61.7 | .00 |
| 3 | 29.85 | 61 | 58 | 29.87 | 71 | 43 | 29.88 | 71 | 51 | 72.5 | 57 | 15.5 | 64.7 | .00 |
| 4 | 30.01 | 63.5 | 64 | 30.00 | 66 | 60 | 30.00 | 63 | 74 | 67 | 57 | 10 | 62 | .12 |
| 5 | 29.93 | 58 | 93 | 29.88 | 57.5 | 97 | 29.83 | 55.5 | 97 | 62 | 55 | 7 | 58.5 | .42 |
| 6 | 29.89 | 62.5 | 74 | 29.91 | 69.5 | 58 | 29.95 | 73 | 54 | 72.5 | 56.5 | 16 | 64.5 | .00 |
| 7 | 30.11 | 67 | 68 | 30.12 | 71.5 | 55 | 30.09 | 73 | 50 | 73.5 | 61.5 | 12 | 67.5 | .00 |
| 8 | 30.09 | 70 | 66 | 30.08 | 80.5 | 48 | 30.07 | 79.5 | 56 | 81.5 | 65.5 | 16 | 73.5 | .00 |
| 9 | 30.05 | 76 | 66 | 30.03 | 83 | 55 | 30.00 | 81 | 59 | 82.5 | 68 | 14.5 | 75.2 | .00 |
| 10 | 30.02 | 74.5 | 72 | 29.98 | 77 | 67 | 29.90 | 81 | 68 | 82.5 | 71 | 11.5 | 76.7 | .00 |
| 11 | 29.85 | 78 | 75 | 29.81 | 87 | 63 | 29.75 | 85 | 61 | 88 | 68 | 20 | 78 | .00 |
| 12 | 29.96 | 76 | 56 | 29.97 | 82.5 | 39 | 29.94 | 83 | 42 | 85 | 65.5 | 19.5 | 75.2 | .45 |
| 13 | 29.79 | 73 | 85 | 29.75 | 81 | 63 | 29.86 | 80.5 | 60 | 81.5 | 64.5 | 17 | 73 | .16 |
| 14 | 30.01 | 72 | 71 | 30.04 | 80.5 | 51 | 30.05 | 79.5 | 57 | 81.5 | 65 | 16.5 | 73.2 | .00 |
| 15 | 30.20 | 68.5 | 70 | 30.25 | 73.5 | 53 | 30.26 | 70 | 64 | 73.5 | 61 | 12.5 | 67.2 | .00 |
| 16 | 30.36 | 71.5 | 78 | 30.37 | 76.5 | 62 | 30.35 | 75.5 | 64 | 77 | 56.5 | 20.5 | 66.7 | .00 |
| 17 | 30.35 | 69 | 68 | 30.31 | 70.5 | 64 | 30.23 | 74.5 | 59 | 76.5 | 64.5 | 12 | 70.5 | .00 |
| 18 | 30.19 | 70 | 82 | 30.14 | 74 | 74 | 30.06 | 71 | 82 | 76 | 67 | 9 | 71.5 | .01 |
| 19 | 30.00 | 70.5 | 84 | 29.97 | 75.5 | 81 | 29.93 | 74.5 | 70 | 77.5 | 66 | 11.5 | 71.7 | .14 |
| 20 | 30.00 | 71 | 90 | 29.99 | 76 | 77 | 29.99 | 80.5 | 57 | 81.5 | 63 | 18.5 | 72.2 | .00 |
| 21 | 30.13 | 69 | 56 | 30.15 | 77.5 | 46 | 30.13 | 78.5 | 50 | 79 | 62 | 17 | 70.5 | .00 |
| 22 | 30.18 | 67 | 66 | 30.19 | 77.5 | 48 | 30.16 | 76.5 | 57 | 78 | 62.5 | 15.5 | 70.2 | .00 |
| 23 | 30.14 | 71 | 60 | 30.06 | 81 | 41 | 30.08 | 78.5 | 56 | 83 | 66 | 17 | 74.5 | .00 |
| 24 | 30.06 | 74 | 61 | 30.04 | 85 | 41 | 30.01 | 86.5 | 44 | 89 | 67 | 22 | 78 | .00 |
| 25 | 30.11 | 77 | 58 | 30.11 | 87.5 | 40 | 30.08 | 88 | 47 | 89 | 69 | 20 | 79 | .00 |
| 26 | 30.11 | 78.5 | 56 | 30.10 | 88.5 | 38 | 30.04 | 88.5 | 45 | 90 | 71 | 19 | 80.5 | .00 |
| 27 | 30.03 | 80 | 57 | 30.02 | 90 | 40 | 30.01 | 77.5 | 67 | 90 | 66 | 24 | 78 | .00 |
| 28 | 30.01 | 71 | 78 | 29.95 | 74.5 | 77 | 29.92 | 75 | 66 | 77 | 67 | 10 | 72 | .01 |
| 29 | 29.95 | 77 | 73 | 29.95 | 85.5 | 51 | 29.94 | 83 | 49 | 86 | 65 | 21 | 75.5 | .00 |
| 30 | 30.13 | 68.5 | 65 | 30.14 | 74.5 | 48 | 30.17 | 70 | 75 | 74 | 64 | 10 | 69 | .00 |
| 31 | 30.31 | 71 | 60 | 30.35 | 72 | 69 | 30.35 | 68.5 | 77 | 74 | 62.5 | 11.5 | 68.2 | .00 |

| | |
|---|---|
| Monthly range | 37° |
| Monthly mean | 70°.83 |
| Monthly rainfall | 1.76 |

## METEOROLOGICAL RECORD FOR AUGUST, 1882.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.39 | 69° | 77 | 30.32 | 77° | 58 | 30.29 | 72°.5 | 65 | 77°.5 | 62° | 15°.5 | 69° 7 | .00 |
| 2 | 30.23 | 71.5 | 67 | 30.17 | 82.5 | 48 | 30.12 | 77.5 | 61 | 81.5 | 62 | 19.5 | 71.7 | .00 |
| 3 | 30.08 | 74 | 63 | 30.07 | 79.5 | 53 | 30.07 | 76 | 62 | 79 | 64 | 15 | 71.5 | .00 |
| 4 | 30.12 | 72 | 76 | 30.13 | 77 | 65 | 30.13 | 76.5 | 64 | 77.5 | 63 | 14.5 | 70.2 | .00 |
| 5 | 30.16 | 72.5 | 72 | 30.17 | 79 | 63 | 30.15 | 80 | 66 | 81.5 | 68 | 13.5 | 74.7 | .00 |
| 6 | 30.13 | 78 | 65 | 30.11 | 82.5 | 49 | 30.07 | 78.5 | 67 | 82.5 | 68 | 14.5 | 75.2 | .00 |
| 7 | 29.98 | 76 | 77 | 29.93 | 83.5 | 66 | 29.81 | 77 | 73 | 84 | 70.5 | 13.5 | 77.2 | .00 |
| 8 | 29.79 | 77 | 79 | 29.73 | 86 | 62 | 29.66 | 77 | 67 | 85.5 | 66.5 | 19 | 76 | .28 |
| 9 | 29.69 | 76 | 82 | 29.73 | 83 | 67 | 29.78 | 79.5 | 66 | 85.5 | 65 | 20.5 | 75.2 | .00 |
| 10 | 29.98 | 72.5 | 69 | 29.99 | 74.5 | 75 | 29.96 | 69 | 82 | 75.5 | 63 | 12.5 | 69.2 | .00 |
| 11 | 30.04 | 70 | 59 | 30.05 | 76.5 | 47 | 30.07 | 76.5 | 52 | 78 | 61.5 | 16.5 | 69.7 | .00 |
| 12 | 30.12 | 68 | 74 | 30.07 | 79.5 | 53 | 30.01 | 74.5 | 70 | 79 | 65 | 14 | 72 | .00 |
| 13 | 29.96 | 78.5 | 45 | 29.96 | 79 | 53 | 30.01 | 75.5 | 52 | 79.5 | 54.5 | 25 | 67 | .00 |
| 14 | 30.11 | 65.5 | 71 | 30.10 | 68.5 | 72 | 30.04 | 69 | 75 | 72.5 | 65 | 7.5 | 68.7 | .00 |
| 15 | 30.04 | 72.5 | 83 | 30.05 | 85 | 55 | 30.05 | 79 | 70 | 85 | 73.5 | 11.5 | 79.2 | .00 |
| 16 | 30.08 | 72.5 | 78 | 30.05 | 70.5 | 51 | 29.91 | 68.5 | 92 | 75 | 66 | 9 | 70.5 | .43 |
| 17 | 29.81 | 74 | 81 | 29.78 | 83.5 | 53 | 29.76 | 79 | 54 | 85.5 | 62.5 | 23 | 74 | .00 |
| 18 | 29.90 | 63 | 61 | 29.91 | 69.5 | 42 | 29.93 | 68.5 | 41 | 71 | 50 | 21 | 60.5 | .00 |
| 19 | 30.09 | 56 | 63 | 30.10 | 67 | 48 | 30.12 | 63 | 64 | 68.5 | 51.5 | 17 | 60 | .00 |
| 20 | 30.24 | 58 | 70 | 30.24 | 69.5 | 50 | 30.26 | 62.5 | 74 | 69 | 52 | 17 | 60.5 | .00 |
| 21 | 30.32 | 59 | 70 | 30.33 | 64 | 62 | 30.31 | 63 | 70 | 67 | 52.5 | 14.5 | 59.7 | .00 |
| 22 | 30.26 | 63 | 69 | 30.21 | 73.5 | 65 | 30.18 | 69 | 72 | 72.5 | 61.5 | 11 | 67 | .00 |
| 23 | 30.19 | 66 | 81 | 30.13 | 76.5 | 62 | 30.06 | 71 | 71 | 76.5 | 63.5 | 13 | 70 | .09 |
| 24 | 29.94 | 67 | 87 | 29.88 | 74 | 77 | 29.83 | 72 | 83 | 74.5 | 61.5 | 13 | 68 | .00 |
| 25 | 29.85 | 65 | 68 | 29.87 | 73.5 | 59 | 29.92 | 68 | 67 | 74.5 | 57 | 17.5 | 65.7 | .00 |
| 26 | 30.13 | 63.5 | 75 | 30.12 | 66 | 73 | 30.12 | 61 | 77 | 66 | 53.5 | 12.5 | 59.7 | .00 |
| 27 | 30.27 | 61 | 80 | 30.27 | 65 | 73 | 30.22 | 63.5 | 75 | 67.5 | 53.5 | 14 | 60.5 | .00 |
| 28 | 30.15 | 60 | 91 | 30.12 | 67 | 64 | 30.12 | 63 | 83 | 68 | 53 | 5 | 55.5 | .00 |
| 29 | 30.14 | 61 | 80 | 30 21 | 67 | 74 | 30.23 | 64 | 88 | 69 | 54 | 15 | 61.5 | .00 |
| 30 | 30.25 | 65 | 73 | 30.24 | 76.5 | 61 | 30.21 | 73.5 | 49 | 76.5 | 59 | 17.5 | 67.7 | .00 |
| 31 | 30.21 | 65 | 75 | 30.20 | 76 | 54 | 30.17 | 71.5 | 69 | 78.5 | 64 | 14.5 | 71.2 | .03 |

| | |
|---|---|
| **Monthly range** | 35°.5 |
| **Monthly mean** | 68°.39 |
| **Monthly rainfall** | .83 |

## METEOROLOGICAL RECORD FOR SEPTEMBER, 1882.

| Date. | 8 A. M. |  |  | 1 P. M. |  |  | 6 P. M. |  |  | 24 hours ending 8 A. M. |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30 14 | 69° | 82 | 30.10 | 78° | 65 | 30.04 | 74°.5 | 77 | 78°.5 | 65° | 13°.5 | 71°.7 | .00 |
| 2 | 30.11 | 70 | 79 | 30.16 | 71.5 | 69 | 30.17 | 65 | 89 | 72.5 | 60.5 | 12 | 66.5 | .00 |
| 3 | 30.21 | 62 | 88 | 30 19 | 66 | 81 | 30.15 | 72 | 71 | 74.5 | 63 | 11.5 | 68.7 | .00 |
| 4 | 30.12 | 69 | 92 | 30.12 | 73.5 | 85 | 30 08 | 71 | 83 | 74 | 65 | 9 | 69.5 | .02 |
| 5 | 30.10 | 69.5 | 77 | 30.13 | 74 | 66 | 30.15 | 68.5 | 74 | 76 | 60 | 16 | 68 | .00 |
| 6 | 30.28 | 65 | 78 | 30.28 | 68.5 | 67 | 30.26 | 60.5 | 91 | 68.5 | 59 | 9.5 | 63.7 | .00 |
| 7 | 30.18 | 61 | 88 | 30.10 | 64.5 | 78 | 30 04 | 63 | 83 | 66 | 62 | 4 | 64 | .00 |
| 8 | 30.00 | 66 | 89 | 29.98 | 70 | 79 | 29.98 | 70 | 82 | 70.5 | 59.5 | 11 | 65 | .30 |
| 9 | 30.05 | 60 5 | 94 | 30 07 | 63 | 88 | 30.06 | 62 | 91 | 65 | 51.5 | 13.5 | 58.2 | .07 |
| 10 | 30.13 | 56.5 | 72 | 30.12 | 62 | 72 | 30.10 | 61.5 | 80 | 64 | 57 | 7 | 60.5 | .00 |
| 11 | 30.06 | 62 5 | 88 | 29.97 | 63.5 | 88 | 29.86 | 57.5 | 100 | 65 | 53 | 12 | 59 | 2.28 |
| 12 | 29.78 | 53.5 | 100 | 29 84 | 62 | 66 | 29.93 | 61.5 | 56 | 65.5 | 45 | 20.5 | 55.2 | .05 |
| 13 | 30.17 | 50 | 75 | 30.20 | 58 | 64 | 30.21 | 56 | 75 | 59 | 49 | 10 | 54 | .00 |
| 14 | 30.16 | 57 | 87 | 30.04 | 61 | 88 | 29.84 | 63 | 88 | 65.5 | 57 | 8.5 | 61.2 | .36 |
| 15 | 29.61 | 63 | 72 | 29.66 | 68 | 64 | 29.75 | 63 | 67 | 67.5 | 51.5 | 16 | 59.5 | .00 |
| 16 | 29.89 | 58 | 67 | 29 83 | 70 | 52 | 29.81 | 66 | 72 | 71 | 49.5 | 21.5 | 60.2 | .00 |
| 17 | 29.91 | 52 | 47 | 29.95 | 64 | 29 | 29.96 | 64 | 48 | 67.5 | 51 | 16.5 | 59.2 | .00 |
| 18 | 29.95 | 64 | 88 | 29.87 | 76 | 71 | 29.92 | 72 | 80 | 80 | 63.5 | 16.5 | 71.7 | .00 |
| 19 | 29.96 | 69 | 87 | 29.94 | 81 | 66 | 29.90 | 76 | 81 | 81 | 66 | 15 | 73.5 | .00 |
| 20 | 29.98 | 71 | 85 | 30.03 | 79.5 | 68 | 30.10 | 73 | 85 | 79.5 | 55 | 24.5 | 67.2 | .05 |
| 21 | 30.31 | 55 | 93 | 30.33 | 54 | 93 | 30.33 | 53 | 93 | 55.5 | 53 | 2.5 | 54.2 | .75 |
| 22 | 30.31 | 55 | 97 | 30 25 | 60 | 97 | 30.16 | 62 | 97 | 66 | 55 | 11 | 60.5 | 2.99 |
| 23 | 30.16 | 66 | 97 | 30.14 | 71.5 | 88 | 30 12 | 68 | 87 | 73 | 63 | 10 | 68 | .27 |
| 24 | 30.08 | 66 5 | 94 | 30.16 | 66 | 89 | 30.24 | 64 | 88 | 67 | 56.5 | 10.5 | 61.7 | .04 |
| 25 | 30 31 | 58 | 72 | 30.32 | 59 | 76 | 30.31 | 59 | 76 | 60 | 56 | 4 | 58 | .03 |
| 26 | 30.25 | 57 | 78 | 30.27 | 59 | 65 | 30 21 | 58 | 64 | 60 | 50 | 10 | 55 | .00 |
| 27 | 30.25 | 53.5 | 71 | 30.28 | 54 | 74 | 30.29 | 52 | 66 | 56 | 45.5 | 10.5 | 50.7 | .00 |
| 28 | 30.29 | 51.5 | 76 | 30.29 | 52 | 80 | 30 27 | 50 | 78 | 53 | 49.5 | 3.5 | 51.2 | .27 |
| 29 | 30.19 | 52 | 86 | 30 20 | 53 | 86 | 30.21 | 55 | 68 | 57 | 52 | 5 | 54.5 | .03 |
| 30 | 30.22 | 53.5 | 66 | 30.22 | 60 | 71 | 30.22 | 59 | 82 | 60.5 | 53.5 | 7 | 57 | .00 |

| | |
|---|---|
| Monthly range | 36°.0 |
| Monthly mean | 61°.6 |
| Monthly Rainfall | 7.51 |

## METEOROLOGICAL RECORD FOR OCTOBER, 1882.

| | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.18 | 58° | 70 | 30.15 | 67°.5 | 55 | 30.11 | 64°.5 | 60 | 67° | 53°.5 | 13°.5 | 60°.2 | .00 |
| 2 | 30.13 | 58.5 | 76 | 30.16 | 65.5 | 52 | 30.16 | 58.5 | 56 | 66 | 40 | 26 | 53 | .00 |
| 3 | 30.26 | 45 | 79 | 30.27 | 54 | 64 | 30.24 | 52 | 60 | 58.5 | 40.5 | 18 | 49.5 | .00 |
| 4 | 30.24 | 43.5 | 84 | 30.24 | 59.5 | 46 | 30.24 | 56 | 65 | 63 | 44 | 19 | 53.5 | .00 |
| 5 | 30.27 | 52 | 73 | 30.30 | 58 | 58 | 30.31 | 56 | 81 | 61.5 | 50 | 11.5 | 55.7 | .00 |
| 6 | 30.42 | 54 | 86 | 30.42 | 58 | 64 | 30.41 | 57 | 75 | 59 | 54.5 | 4.5 | 56.7 | .00 |
| 7 | 30.31 | 58 | 87 | 30.22 | 66.5 | 78 | 30.15 | 63 | 88 | 67 | 56.5 | 10.5 | 61.7 | .00 |
| 8 | 30.11 | 58.5 | 94 | 30.08 | 71.5 | 78 | 30.05 | 68.5 | 77 | 74.5 | 56 | 18.5 | 65.2 | .00 |
| 9 | 30.07 | 59.5 | 97 | 30.02 | 69 | 75 | 29.97 | 63 | 74 | 69.5 | 54.5 | 15 | 62 | .00 |
| 10 | 29.91 | 56.5 | 63 | 29.91 | 66 | 52 | 29.91 | 60 | 55 | 66.5 | 41.5 | 25 | 54 | .00 |
| 11 | 30.07 | 45 | 72 | 30.13 | 49 | 64 | 30.18 | 46 | 69 | 50 | 45 | 5 | 47.5 | .00 |
| 12 | 30.30 | 50 | 71 | 30.35 | 53 | 74 | 30.35 | 51.5 | 79 | 54 | 48 | 6 | 51 | .00 |
| 13 | 30.31 | 52 | 76 | 30.30 | 54.5 | 68 | 30.25 | 51.5 | 72 | 55.5 | 49.5 | 6 | 52.5 | .06 |
| 14 | 30.11 | 53 | 97 | 30.10 | 49.5 | 100 | 30.08 | 51 | 93 | 52 | 47.5 | 4.5 | 49.7 | 1.17 |
| 15 | 30.12 | 48 | 85 | 39.13 | 57 | 69 | 30.13 | 53.5 | 71 | 59 | 48.5 | 10.5 | 53.7 | .00 |
| 16 | 30.17 | 54.5 | 83 | 30.18 | 54 | 93 | 30.18 | 53.5 | 97 | 57 | 53 | 4 | 55 | .06 |
| 17 | 30.11 | 55.5 | 100 | 30.07 | 66 | 87 | 30.05 | 62 | 94 | 66.5 | 56 | 10.5 | 61.2 | .02 |
| 18 | 30.05 | 63 | 100 | 30.06 | 71 | 85 | 30.02 | 65 | 89 | 70.5 | 56 | 14.5 | 63.2 | .22 |
| 19 | 29.89 | 58.5 | .97 | 29.91 | 59 | 91 | 29.92 | 57.5 | 93 | 61 | 45 | 16 | 53 | .19 |
| 20 | 30.11 | 46 | 76 | 30.17 | 50.5 | 72 | 30.19 | 49 | 74 | 51.5 | 40 | 11.5 | 45.7 | .00 |
| 21 | 30.28 | 41 | 87 | 30.32 | 51 | 62 | 30 35 | 46.5 | 63 | 51 | 40 | 11 | 45.5 | .00 |
| 22 | 30.35 | 45 | 88 | 30.33 | 52.5 | 63 | 30.29 | 51.5 | 72 | 53 | 45.5 | 7.5 | 49.2 | .00 |
| 23 | 30.14 | 50 | 89 | 30.07 | 53 | 86 | 30.00 | 53 | 86 | 54.5 | 50 | 4.5 | 52.2 | .00 |
| 24 | 29.85 | 51 | 100 | 29.79 | 53.5 | 89 | 29.74 | 53.5 | 86 | 54 | 44.5 | 9.5 | 49.2 | .03 |
| 25 | 29.73 | 47 | 70 | 29.75 | 54 | 46 | 29.82 | 49.5 | 44 | 55 | 39 | 16 | 47 | .00 |
| 26 | 29.85 | 46 | 76 | 29.83 | 65 | 39 | 29.87 | 50 | 72 | 64 | 34 | 30 | 49 | .00 |
| 27 | 30.06 | 40 | 73 | 30.07 | 54 | 38 | 30.08 | 52 | 53 | 55 | 37.5 | 17.5 | 46.2 | .00 |
| 28 | 30.19 | 39 | 72 | 30.25 | 49 | 43 | 30.27 | 46.5 | 51 | 49.5 | 38.5 | 11 | 44 | .00 |
| 29 | 30.27 | 50 | 71 | 30.16 | 54 | 86 | 30.01 | 57 | 82 | 58 | 50 | 8 | 54 | .01 |
| 30 | 30.07 | 58 | 64 | 30.09 | 60 | 49 | 30.10 | 52 | 80 | 61 | 40 | 21 | 50.5 | .00 |
| 31 | 30.17 | 43.5 | 84 | 40.15 | 57 | 78 | 30.02 | 58 | 89 | 64 | 45 | 19 | 54.5 | .01 |

Monthly range.................................40°.5
Monthly mean ..........  ......................  53°.10
Monthly rainfall...............................  1.77

## METEOROLOGICAL RECORD FOR NOVEMBER, 1882.

| Date. | 8 A. M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.04 | 63°.5 | 86 | 30.05 | 68° | 67 | 30.08 | 59° | 85 | 63°.5 | 43°.5 | 20° | 53°.5 | .00 |
| 2 | 30.16 | 45 | 49 | 30.21 | 48.5 | 40 | 30.25 | 39.5 | 44 | 49.5 | 29.5 | 20 | 39.5 | .00 |
| 3 | 30.43 | 32 | 59 | 30.46 | 40.5 | 49 | 30.46 | 40 | 60 | 43.5 | 33 | 10.5 | 38.2 | .00 |
| 4 | 30.47 | 34 | 62 | 30.47 | 40 | 46 | 30.48 | 35.5 | 58 | 40.5 | 28.5 | 12 | 34.5 | .00 |
| 5 | 30.49 | 30.5 | 78 | 30.49 | 35 | 67 | 30.48 | 36.5 | 59 | 36.5 | 29.5 | 7 | 33 | .00 |
| 6 | 30.44 | 31.5 | 58 | 30.43 | 41 | 57 | 30.42 | 41.5 | 57 | 42 | 35.5 | 6.5 | 38.7 | .01 |
| 7 | 30.41 | 37 | 81 | 30.41 | 42 | 83 | 30.40 | 41 | 83 | 43 | 36.5 | 6.5 | 39.7 | .02 |
| 8 | 30.35 | 37 | 90 | 30.33 | 43.5 | 75 | 30.30 | 42 | 78 | 44 | 32.5 | 11.5 | 38.2 | .00 |
| 9 | 30.25 | 36 | 81 | 30.24 | 49 | 64 | 30.21 | 46.5 | 76 | 50.5 | 35.5 | 15 | 43 | .00 |
| 10 | 30.19 | 44.5 | 88 | 30.20 | 54 | 80 | 30.22 | 52 | 83 | 56 | 40 | 16 | 48 | .00 |
| 11 | 30.30 | 42 | 95 | 30.33 | 49 | 89 | 30.31 | 46 | 96 | 56 | 44.5 | 11.5 | 50.2 | .00 |
| 12 | 30.12 | 56 | 81 | 30.05 | 63.5 | 72 | 29.98 | 56.5 | 81 | 63.5 | 53.5 | 10 | 58.5 | .00 |
| 13 | 29.97 | 53.5 | 86 | 29.89 | 56 | 87 | 29.72 | 58.5 | 79 | 60 | 36 | 24 | 48 | .12 |
| 14 | 29.84 | 37 | 63 | 29.86 | 41.5 | 39 | 29.86 | 40 | 52 | 43.5 | 31 | 12.5 | 37.2 | .00 |
| 15 | 29.91 | 32 | 75 | 29.96 | 44 | 41 | 29.99 | 40 | 65 | 44.5 | 33 | 11.5 | 38.7 | .00 |
| 16 | 30.12 | 35 | 71 | 30.18 | 48 | 46 | 30.21 | 44 | 52 | 49.5 | 33 | 16.5 | 41.2 | .17 |
| 17 | 30.26 | 33 | 89 | 30.28 | 33.5 | 84 | 30.28 | 33.5 | 90 | 34.5 | 25 | 9.5 | 29.7 | .28 |
| 18 | 30.28 | 25 | 74 | 30.29 | 30 | 78 | 30.28 | 29 | 72 | 31.5 | 21.5 | 10 | 26.5 | .00 |
| 19 | 30.23 | 22.5 | 66 | 30.19 | 32 | 79 | 30.15 | 31.5 | 54 | 35 | 23 | 12 | 29 | .00 |
| 20 | 30.09 | 24 | 74 | 30.05 | 35 | 58 | 30.03 | 34 | 66 | 37 | 24 | 13 | 30.5 | .00 |
| 21 | 30.00 | 26 | 69 | 30.00 | 38 | 64 | 29.99 | 34 | 66 | 39 | 27.5 | 11.5 | 33.2 | .00 |
| 22 | 29.96 | 31 | 63 | 29.96 | 39 | 68 | 29.96 | 37 | 59 | 40 | 28 | 22 | 39 | .00 |
| 23 | 30.00 | 28.5 | 83 | 30.03 | 41 | 57 | 30.04 | 42.5 | 67 | 43.5 | 28.5 | 15 | 36 | .00 |
| 24 | 29.97 | 42.5 | 91 | 29.87 | 48 | 62 | 29.85 | 40 | 69 | 48.5 | 35 | 13.5 | 41.7 | .00 |
| 25 | 29.88 | 33.5 | 75 | 29.91 | 37 | 63 | 29.96 | 34 | 48 | 37.5 | 26.5 | 11 | 32 | .00 |
| 26 | 30.09 | 26.5 | 63 | 30.09 | 33.5 | 66 | 30.08 | 33 | 56 | 35 | 26 | 9 | 30.5 | .19 |
| 27 | 29.95 | 25 | 74 | 29.96 | 28 | 65 | 29.98 | 25 | 62 | 29 | 18 | 11 | 23.5 | .00 |
| 28 | 30.05 | 20 | 70 | 30.08 | 32 | 69 | 30.10 | 29.5 | 73 | 34.5 | 21.5 | 13 | 28 | .00 |
| 29 | 30.10 | 27.5 | 82 | 30.04 | 31.5 | 89 | 29.99 | 27 | 94 | 32.5 | 27.5 | 5 | 30 | .37 |
| 30 | 29.97 | 26 | 63 | 29.98 | 29 | 66 | 30.00 | 23 | 66 | 30.5 | 19.5 | 11 | 25 | .00 |

| | |
|---|---|
| **Monthly range** | **45°.5** |
| **Monthly mean** | **36°.07** |
| **Monthly rainfall** | **1.16** |

## METEOROLOGICAL RECORD FOR DECEMBER, 1882.

| Date. | 8. A M. | | | 1 P. M. | | | 6 P. M. | | | 24 hours ending 8 A. M. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Barometer. | Thermometer. | Humidity. | Maximum Thermometer. | Minimum Thermometer. | Daily range. | Daily mean. | Rainfall. |
| 1 | 30.02 | 28° | 65 | 30.01 | 36° | 67 | 30.00 | 36° | 71 | 39° | 28°.5 | 10°.5 | 33°.7 | .00 |
| 2 | 30.03 | 36.5 | 76 | 30.00 | 44 | 68 | 29.96 | 43 | 83 | 46 | 26 | 20 | 36 | .00 |
| 3 | 29.92 | 26 | 63 | 29.93 | 22 | 59 | 29.95 | 13.5 | 45 | 27 | 7 | 20 | 17 | .00 |
| 4 | 30.04 | 8.5 | 24 | 30.09 | 21.5 | 50 | 30.12 | 22 | 52 | 33 | 9 | 24 | 21 | .00 |
| 5 | 30.16 | 35.5 | 85 | 30.16 | 45 | 84 | 30.18 | 41.5 | 78 | 49 | 36.5 | 12.5 | 42.7 | .19 |
| 6 | 30.00 | 49 | 82 | 29.98 | 46 | 60 | 30.02 | 40.5 | 69 | 50 | 30 | 20 | 40 | .00 |
| 7 | 30.08 | 36 | 90 | 29.95 | 44 | 84 | 29.92 | 21 | 57 | 45 | 15 | 30 | 30 | .09 |
| 8 | 30.00 | 15 | 39 | 30.02 | 21 | 36 | 30.06 | 19.5 | 40 | 22.5 | 15 | 7.5 | 18.7 | .00 |
| 9 | 30.14 | 15 | 47 | 30.16 | 25.5 | 56 | 30.18 | 25 | 62 | 28 | 16 | 12 | 22 | .11 |
| 10 | 30.19 | 26 | 63 | 30.15 | 28.5 | 72 | 30.10 | 29.5 | 73 | 32 | 28 | 4 | 30 | .18 |
| 11 | 30.02 | 26 | 74 | 29.94 | 26.5 | 87 | 29.91 | 28.5 | 100 | 32.5 | 19 | 13.5 | 25.7 | .11 |
| 12 | 29.97 | 18 | 68 | 30.08 | 25 | 62 | 29.18 | 24.5 | 49 | 28.5 | 19 | 9.5 | 23.7 | .00 |
| 13 | 30.27 | 21.5 | 79 | 30.22 | 35 | 80 | 30.12 | 39 | 91 | 41 | 24 | 17 | 32.5 | .26 |
| 14 | 29.88 | 29 | 44 | 29.83 | 33 | 61 | 29.80 | 30 | 56 | 33 | 22 | 11 | 27.5 | .00 |
| 15 | 29.76 | 22 | 79 | 29.76 | 26 | 45 | 29.76 | 22 | 79 | 28 | 13.5 | 14.5 | 20.7 | .00 |
| 16 | 29.78 | 14 | 63 | 29.77 | 22.5 | 65 | 29.76 | 17 | 67 | 19.5 | 15 | 4.5 | 17.2 | .00 |
| 17 | 29.76 | 18.5 | 46 | 29.78 | 29.5 | 61 | 29.81 | 27.5 | 52 | 31.5 | 16 | 15.5 | 23.7 | .00 |
| 18 | 29.95 | 16.5 | 75 | 29.99 | 29 | 77 | 30.03 | 27 | 76 | 30 | 16 | 14 | 23 | .00 |
| 19 | 30.21 | 16.5 | 75 | 30.24 | 31.5 | 59 | 30.26 | 28 | 65 | 32 | 17 | 15 | 24.5 | .00 |
| 20 | 30.31 | 19 | 54 | 30.32 | 30.5 | 63 | 30.34 | 27.5 | 71 | 32 | 19.5 | 12.5 | 25.7 | .00 |
| 21 | 30.36 | 25 | 68 | 30.36 | 33 | 79 | 30.35 | 29 | 77 | 33.5 | 26 | 7.5 | 29.7 | .00 |
| 22 | 30.33 | 29 | 73 | 30.31 | 35 | 85 | 30.27 | 35 | 90 | 39 | 30.5 | 8.5 | 34.7 | .45 |
| 23 | 29,97 | 39 | 91 | 29.87 | 34.5 | 90 | 30.36 | 36.5 | 81 | 39.5 | 33 | 6.5 | 36.2 | .07 |
| 24 | 29.87 | 34 | 75 | 29.86 | 39.5 | 82 | 29.87 | 36.5 | 63 | 40 | 32.5 | 7·5 | 36.2 | .00 |
| 25 | 29.95 | 33.5 | 75 | 30.01 | 38 | 64 | 30.09 | 33.5 | 75 | 39 | 29 | 10 | 34 | .00 |
| 26 | 30.18 | 29 | 55 | 30.17 | 36.5 | 71 | 30.16 | 35 | 76 | 38 | 27 | 11 | 32.5 | .01 |
| 27 | 30.13 | 27 | 64 | 30.13 | 34 | 62 | 30.12 | 34.5 | 66 | 35.5 | 25 | 10.5 | 30.2 | .00 |
| 28 | 30.15 | 25 | 62 | 30.16 | 31 | 58 | 30.16 | 26 | 57 | 31.5 | 17 | 14.5 | 24.2 | .00 |
| 29 | 30.17 | 17 | 83 | 30.19 | 29 | 77 | 30.20 | 29.5 | 73 | 32.5 | 18 | 14.5 | 25.2 | .00 |
| 30 | 30.21 | 22 | 85 | 30.19 | 33.5 | 75 | 30.17 | 31 | 58 | 34.5 | 25 | 9.5 | 29.7 | .00 |
| 31 | 30.17 | 31 | 63 | 30.17 | 36 | 63 | 30.16 | 34.5 | 66 | 37 | 29.5 | 7.5 | 33.2 | .00 |

| | | | |
|---|---|---|---|
| **Monthly range** | 43°.00 | | |
| **Monthly mean** | | 28°.45 | |
| **Monthly rainfall** | | | 1.84 |

M. N. Baker

# TWELFTH ANNUAL REPORT

OF THE

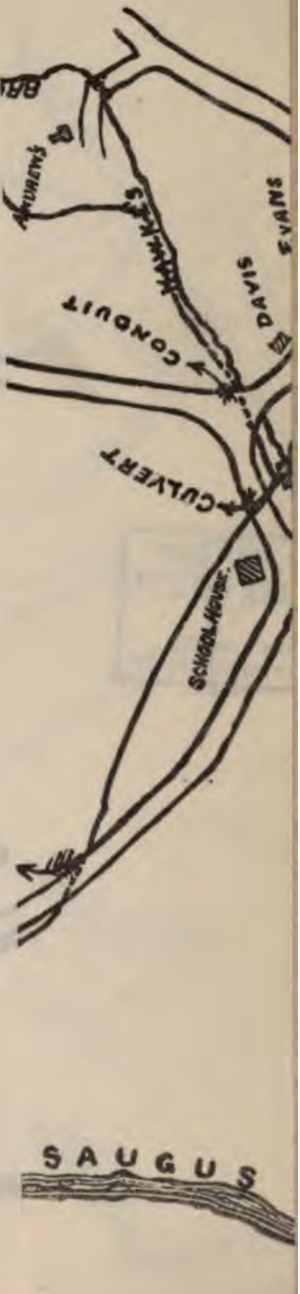
# PUBLIC WATER BOARD

OF THE

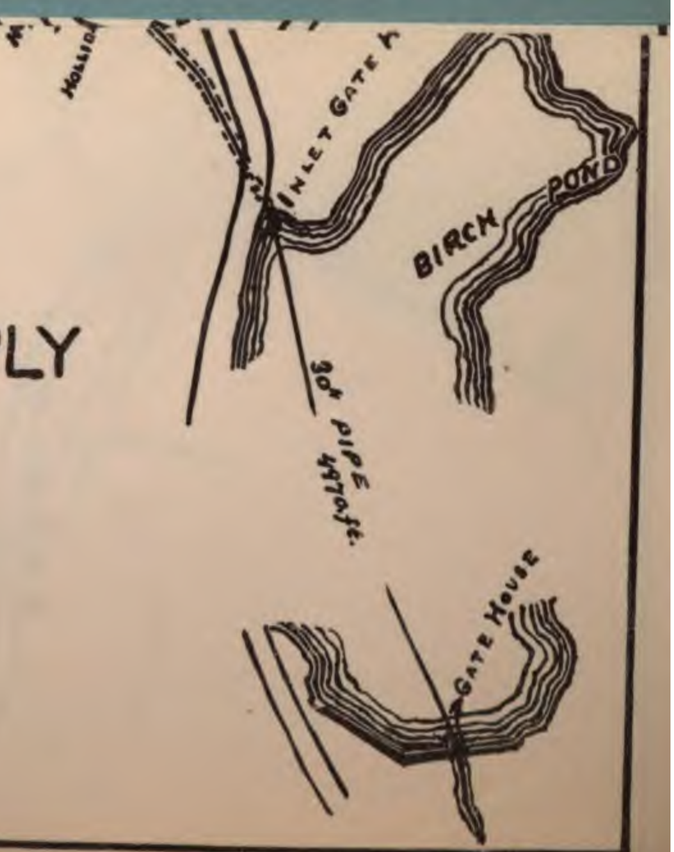
# CITY OF LYNN,

FOR THE YEAR ENDING DECEMBER 31, 1883.

LYNN, MASS.
JOHN MACFARLANE & CO., PRINTERS,
No. 55 MUNROE STREET.
1884.


ANDREW'S
HAWKES
EVANS
DAVIS
CONDUIT
CULVERT
SCHOOL HOUSE
SAUGUS

# CITY of LYNN
## LOCATION OF
# NEW WATER SUPPLY
1883



# TWELFTH ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD

OF THE

# CITY OF LYNN,

FOR THE YEAR ENDING DECEMBER 31, 1883.

LYNN, MASS.
JOHN MACFARLANE & CO., PRINTERS,
No. 55 MUNROE STREET.
1884.

# PUBLIC WATER BOARD.

## OFFICERS FOR 1883.

**JAMES N. BUFFUM, *President*,**
**For one year.**

**ALBERT A. DAVIS,**
**For five years.**

**THOMAS B. NEWHALL.**
**For four years.**

**EDWIN WALDEN,**
**For three years.**

**JOSEPH M. ROWELL,**
**For two years.**

***Supt. and Clerk*,**
**JAMES W. LYON.**

***Water Registrar*,**
**FRANK DAVIS.**

***Inspector*,**
**WILLIS L. SNOW.**

***Foreman of Piping*,**
**J. J. LEAVY.**

***Engineer*,**
**W. H. MESSINGER.**

***Foreman of Services*,**
**EDWIN MAXWELL.**

## OFFICERS FOR 1884.

EDWIN WALDEN, *President*,
For two years.

JOSEPH M. ROWELL,
For one year.

THOMAS B. NEWHALL,
For three years.

ALBERT A. DAVIS,
For four years.

D. H. SWEETSER,
For five years.

*Superintendent and Clerk*,
DANIEL WALDEN.

*Water Registrar*,
FRANK McCULLOUGH.

*Pumping Engineer*,
WM. H. MESSINGER.

*Foreman of Piping*,
EDWIN MAXWELL.

*Inspectors*,
WINSLOW J. ROWELL. WILLIS L. SNOW, J. FRANK POOL.

# ANNUAL REPORT

OF THE

# PUBLIC WATER BOARD.

OFFICE OF THE PUBLIC WATER BOARD,
*January 4th, 1884.*

*To the City Council of the City of Lynn:*

In presenting to you the Annual Report of the Public Water Board, we have to say: That the Superintendent and Registrar have covered the ground so fully, and stated so clearly the present condition of the water works, and what has been accomplished the past year, that it will require but little more than the indorsement of their reports by the Board.

Suffice it to say, that the past year has been one of great labor, and has given the Board much anxiety, both on account of the great repairs needed on the old works, and new supply ordered by the City Government.

You will see by the Report of the Superintendent, of last year, that he stated "that all things were in good condition at the pumping station. The engine had run ten years with an outlay of not much over ten dollars a year, and might now want some slight repairs, as some parts were a little worn." But upon examination, as you will see by the Report of the Superintendent, the house was found so leaky that the covering of the flat parts of the roof had to be renewed with tin in the best manner; the pipes of the boiler had to be extensively repaired; the pumping engine was, upon examination, not only a little worn, but both cylinders were so badly cracked that they were condemned by the inventor, and have been sent to Philadelphia as patterns for new ones to supply their places. What the cost will be cannot be determined until the bill is rendered.

The pipes in the streets are becoming weak, and are frequently bursting, causing much trouble and labor to the Superintendent, and cost to the city by damage to business men from water flooding into their premises, for which the city have had to pay large sums in compensation, and it becomes a question worthy of consideration whether it would not be a wise thing to do, to lay down through such streets as were most occupied by business men, and where the greatest damage would be likely to occur from a like disaster, substantial iron pipes that will stand any pressure required.

You will see by these brief statements, and the full report of the Superintendent, that the past year has been one of great labor and anxiety, and while the Board have endeavored to faithfully discharge their duty, they are bound to say, that they have been greatly aided by the skill and energy of the Superintendent, who has most faithfully performed his duty. All of which is

Respectfully submitted,

JAMES N. BUFFUM,
JOSEPH M. ROWELL,
A. A. DAVIS.

# REPORT OF THE WATER REGISTRAR.

*Hon. James N. Buffum, President of the Public Water Board:*

DEAR SIR: — In accordance with the requirements of the City Ordinances, I hereby present the Report of the Water Registrar for the year ending Dec. 31, 1883.

## SERVICES.

Whole number of services Jan. 1, 1883, was 5,439; number of new services put in during the year, 550; total number to Jan. 1, 1884, 5,989. There was shut off during the year for non-payment, 2; let on again by payment of rates and fines, 2: let on for other parties, the premises having changed hands, 2; number let on that was shut off previous to 1883, 2. At the begining of the year there were 52 services shut off and premises vacant. There have been shut off during the year by request or for vacancies, 78; let on again, premises re-occupied, 84; still remaining off 46.

There has been 3 new services put in at East Saugus during the year, making the whole number in that place up to Jan. 1, 1884, 59.

The ratio of increase in the number of services for the last eight years is as follows: —

| | | | |
|---|---|---|---|
| In 1876 . . | 6.54 per cent. | In 1880 . . | 8.75 per cent. |
| 1877 . . | 7.60 " " | 1881 . | 10.25 " " |
| 1878 . . | 6.14 " " | 1882 . . | 9.92 " " |
| 1879 . . | 6.04 " " | 1883 . | 10.80 " " |

More attention has been paid to the inspection of the fixtures of water takers this year, and the results bear out the recommendation of the former Registrar, that one inspector cannot examine all of the premises of the water takers, and it is doubtful if two inspectors could thoroughly perform this duty, and see that fixtures leaking and out of repair were put in proper condition. In August the Board elected an office assistant, which relieved the inspector of all office work, and his whole time was then devoted to inspecting. The results speak for themselves; 94 water-closets, 7 urinals, 23 bath tubs, 342 faucets, 22 hose cocks, 12 engines and boilers, were found, which had never been previously reported, for the most of which bills were presented and paid. A large number of leaky fixtures were found, the owners notified, and were attended to at once. So that no service has been shut off during the year for non-compliance with the rules and regulations in this respect.

I would most respectfully call the attention of the Board to the fact that one inspector cannot examine all the fixtures of water takers in the city, each year, and to obtain all rates, properly belonging to the city, as well as to check the waste of water, would seem to warrant a thorough inspection of all fixtures each year.

### RECEIPTS FOR THE YEAR 1883.

| | | |
|---|---|---|
| For the use of water for all purposes | $98,816 08 | |
| For fines — shutting off and letting on | 4 00 | |
| For Rent | 20 00 | |
| For Summonses | 95 80 | |
| | | $98,935 88 |
| For extra pipe, labor, etc. | | 2,029 67 |
| Total receipts | | $190,965 55 |

All of which has been paid into the city treasury, and the Treasurer's receipts taken therefor.

There is due on ordinary water rates, $583.17; on meter rates, $3,515.73; on account of extra pipe, $208.16.

## EXPENDITURES FOR 1882.

| | | |
|---|---|---|
| Salaries and office expenses | $3,829 76 | |
| Repairs on services and meters | 3,693 35 | |
| Repairs on boilers | 8 66 | |
| Repairs on mains, hydrants and gates | 955 03 | |
| Repairs on engine house | 819 15 | |
| Pumping, wages, coal, oil, etc. | 6,841 46 | |
| Stable and work shop | 1,270 00 | |
| Tubular Wells | 3,528 23 | |
| Repairs on Engine | 510 36 | |
| Total maintenance | | $21,456 14 |

### CONSTRUCTION.

| | | |
|---|---|---|
| Services and court mains | $9,005 63 | |
| Mains, hydrants and gates | 30,873 29 | |
| Meters | 799 57 | |
| Birch Pond (Otis execution) | 2,000 25 | |
| Tubular Wells | 1,090 50 | |
| New engine, as per contract | 6,800 00 | |
| New supply | 48,213 17 | |
| Labor and material on new engine, including foundation, connections etc | 1,755 28 | |
| Total construction | | $100,537 69 |

## COMPARATIVE STATEMENT OF REVENUE FOR 1883.

| | | |
|---|---|---|
| Amount collected in 1883 | $98,935 88 | |
| Due and uncollected | 4,309 06 | |
| | | $103,244 94 |
| Deduct the amount due at beginning of year | | 4,351 40 |
| Revenue for 1883 | | $98,893 54 |
| Revenue for 1882 | | 94,419 52 |
| Increase of revenue for 1883 | | $4,472 02 |

## OF INTEREST, MAINTENANCE AND REVENUE FOR 1883.

| | | |
|---|---|---|
| 3........................ ..... | | $98,893 54 |
| ...................................... | $55,436 87 | |
| nance 1883........................... | 21,456 14 | |
| | | 75,893 01 |
| ess of revenue over interest and maintenance. | | $22,000 53 |

Following will be found the usual tables, exhibiting the mber of dwellings, families, stores, factories, etc., the rly revenue e , the class of premises which meters are attached, umber and kind of fixres, etc., etc.

All of which is respectfully submitted,

FRANK DAVIS, *Registrar.*

# STATEMENT

SHOWING THE NUMBER OF FAMILIES, DWELLINGS, STORES, FACTORIES, ETC., SUPPLIED WITH CITY WATER FOR 1883.

| | |
|---|---|
| Dwellings | 5,338 |
| Families | 7,942 |
| Boarding Houses | 92 |
| Hotels | 11 |
| Stores and Shops | 439 |
| Offices | 148 |
| Restaurants and saloons | 67 |
| Stables | 250 |
| Stationary steam engines | 115 |
| Railroads | 3 |
| City, five engine-houses | 4 |
| School-Houses | 29 |
| Churches | 16 |
| Public halls and buildings | 15 |
| Printing offices | 9 |
| Green houses | 20 |
| Bakeries | 9 |
| Barber shops | 18 |
| Plaining mills | 4 |
| Machine and blacksmith shops | 14 |
| Markets | 8 |
| Banks | 6 |
| Photographers | 6 |
| Public and drinking fountains | 8 |
| Motors | 10 |
| Laundries | 4 |
| Reservoirs | 4 |
| Foundry | 1 |
| Private fountains | 16 |
| Gas works | 1 |
| Steam heating works | 1 |
| Old Ladies' Home | 1 |
| City Hall | 1 |
| City Hospital | 1 |
| Alms House | 1 |
| Post Office | 1 |
| Hand Hose | 1,206 |
| Fire Hydrants | 527 |

# STATEMENT

### SHOWING THE YEARLY REVENUE OF THE DEPARTMENT SINCE THE FIRST INTRODUCTION OF WATER INTO THE CITY IN 1871.

| | | |
|---|---|---|
| From October 1, 1871, to January 1, 1872 | $8,989 | 00 |
| From January 1, 1872, to January 1, 1873 | 27,568 | 16 |
| From January 1, 1873, to January 1, 1874 | 47,992 | 61 |
| From January 1, 1874, to January 1, 1875 | 53,545 | 61 |
| From January 1, 1875, to January 1, 1876 | 52,553 | 26 |
| From January 1, 1876, to January 1, 1877 | 60,867 | 12 |
| From January 1, 1877, to January 1, 1878 | 64,002 | 50 |
| From January 1, 1878, to January 1, 1879 | 67,570 | 14 |
| From January 1, 1879, to January 1, 1880 | 73,949 | 80 |
| From January 1, 1880, to January 1, 1881 | 79,635 | 12 |
| From January 1, 1881, to January 1, 1882 | 80,967 | 76 |
| From January 1, 1882, to January 1, 1883 | 94,419 | 52 |
| From January 1, 1883, to January 1, 1884 | 98,935 | 88 |
| Total | $810,996 | 28 |

# STATEMENT

## SHOWING THE NUMBER AND KIND OF FIXTURES CONTAINED WITHIN THE PREMISES OF WATER TAKERS TO DEC. 31, 1883, COMPARED WITH THE PREVIOUS YEAR.

| Kind of Fixtures | 1882. | 1883. | Increase. |
|---|---|---|---|
| Faucets | 10,905 | 13,209 | 2,304 |
| Bath tubs | 578 | 670 | 92 |
| Water closets | 1,943 | 2,185 | 242 |
| Urinals | 70 | 82 | 12 |
| Hand hose | 1,157 | 1,206 | 49 |

# STATEMENT

## EXHIBITING THE CLASS OF PREMISES TO WHICH METERS ARE ATTACHED.

| Class. | Size. | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | 1-2 | 5-8 | 3-4 | 1 | 1 1-4 | 1 1-2 | 2 | 3 | |
| Factories | 3 | 22 | 42 | 40 | 1 | | | | 108 |
| Railroads | | | 6 | 1 | | | 2 | 1 | 10 |
| Engines | | 2 | 6 | 11 | 1 | 3 | | | 23 |
| Halls and buildings | | 1 | 2 | 8 | | | | | 11 |
| Hotels | | 1 | 2 | | | 1 | | | 4 |
| Livery stables | | 5 | | | | | | | 5 |
| Saloons | | | 1 | 3 | | | | | 4 |
| Laundry | | | | 1 | | | | | 1 |
| Gas works | | | | | | 1 | | | 1 |
| Steam works | | | | | 1 | | | | 1 |
| Fire engine house | | | | 1 | | | | | 1 |
| Dwelling | | 1 | | | | | | | 1 |
| Printing offices | | 2 | | | | | | | 2 |
| Medical laboratory | | 1 | | 1 | | | | | 2 |
| Bath rooms | | 1 | | | | | | | 1 |
| City stables | | | | 1 | | | | | 1 |
| Brick yard | | | | 2 | | | | | 2 |
| Totals | 3 | 36 | 59 | 69 | 3 | 5 | 2 | 1 | 178 |

## DETAILED STATEMENT SHOWING COST OF THE WORKS TO JAN. 1, 1884.

| | | |
|---|---|---|
| Breed's pond and land | $37,814 51 | |
| Birch Pond and land | 45,640 32 | |
| Pipe, conduit and right of way | 43,785 98 | |
| Reservoir and land | 131,482 30 | |
| Force main and land | 24,614 00 | |
| Engine house and land | 56,400 04 | |
| Engine and boilers | 71,998 00 | |
| Mains, hydrants and gates | 550,210 92 | |
| Service and court mains | 146,150 78 | |
| Meters | 6,764 31 | |
| Workshop and stable | 1,785 99 | |
| Engineering | 8,564 99 | |
| Tubular wells | 7,313 79 | |
| Total cost | | $1,132,525 93 |
| By amount received for extra pipe, labor, etc. | | 44,332 98 |
| Net cost of works, not including new supply. | | $1,088,192 95 |

# REPORT OF THE SUPERINTENDENT.

*To Hon. James N. Buffum, President of Lynn Public Water Board*:

SIR: — I would respectfully submit the Report of the Superintendent for the year ending Dec. 31, 1883.

The ponds at the beginning of the year contained but a small supply of water, (91,672,000 gallons in both.) The very small amount of rainfall of the previous year, and the very large increase of consumption, having reduced the supply to but 90 days' consumption, and this at a period of the year when but little water could be expected from the water shed, and there being but very little snow on the ground, the pond did not fill, and at the first of May Breed's pond had but 15 feet 7 inches of water, and Birch pond but 9 feet and 6 inches, only 181,000,000 gallons of water with which to supply the city for the coming summer. This small supply, supplemented by what water has been pumped from the tubular wells, and the exceedingly small amount of rainfall, has furnished thus far what water has been used in the city, and is a very gratifying evidence of great economy in the use of water as compared with its use in other cities. No work has been done at Breed's pond except grading the road at the upper end that was not completed last year.

At Birch pond, the scheme for an additional supply made provision for raising the dam, and doing other work there. It was not thought advisable to spend any labor about the pond.

On September 4th, the City Council directed the Water Board to clean Birch pond by burning, "provided it can be satisfactorily done at an expense not exceeding $4,000.00." But as no one could be found willing to undertake it for that sum, it was not attempted.

Some few experiments, looking to the removal of the stumps by blasting were made, but were not very satisfactory. Water was used from Birch pond until July 1st, when it was shut off, having become too foul for use from the muacculation of Algæ in the water. At this time there was but 7 feet 2 inches of water in the pond. The water from Breed's pond has been of good quality, and not much affected by the Algæ, owing probably to the cold water from the tubular wells, which was pumped into it.

The consumption from both ponds has been, 568,660,447 gallons, of which 144,233,861 gallons has been obtained from the tubular wells, and was pumped to Breed's pond, and from there supplied to the pumping station. Increase of consumption over that of 1882, 17,231,540 gallons.

### THE RESERVOIR

Is in good condition, and has required no repairs this year. A new iron door has been made for the gate house, as the wooden one had become of no use except as a target for the many amatuers who wished to try their rifles upon it. Ice has moved the rip rap stones about high water mark, which will probably have to be replaced in the Spring.

### THE PUMPING STATION

Is now in good repair. Early in the Spring it was found that in order to prevent damage to the engines and boilers it would be necessary to renew the covering on the flat parts of the roof of both pump and boiler houses. This was done in the most thorough manner, by Messrs. Burns & Bee, by removing the old copper roof, and substituting best tin, painted on both sides, it is now perfectly tight. Concrete gutters have been laid from the leaders to carry the water from the roof away from the building.

The boiler room and basement of pump house have been white-washed, and the wainscoting, windows, and floor of engine room thoroughly cleaned. An inspection of the cylinder of the Leavitt pump having revealed the fact that the crack in the low pressure cylinder, which had been known and partly repaired in 1878, had extended quite around the inside and further inspection showed that the high pressure cylinder was also cracked and in a very dangerous condition. The patentee, Mr. E. D. Leavitt was called in, and after inspection reported that the cylinders were in too dangerous a condition to remain, and that measures should be taken at once to replace them, as it was a great risk to depend on them alone.

In view of these facts the City Council voted an appropriation of $9,000 and a contract was made with the Dean Steam Pump Co., for a 3,000,000 pump, and with Mr. Davidson, of Lynn, for the necessary foundation. Work was commenced at once and pushed with all speed till July 18th, since which time it has pumped all the water furnished to the city.

A thorough test of the pump was made before acceptance of the pump by the Board, a report of which is annexed to this report.

The whole cost of the pump, including foundations, connection to the twenty inch force main, (which was done by the employes of the Board) and all gates and piping complete, was $8,455.00.

It is a very beautiful machine, and in both duty and capacity exceeds the amount guaranteed by the contractor.

The cylinders and all parts attached to them of the old engine, was sent to the I. P. Morris Co., at Philadelphia, and new ones with patent expansion joints have been made and are now being put in at the pumping station.

This will make the plant nearly perfect, all that is needed is another boiler, as should anything happen to those now in use, we should be unable to continue pumping till one could be provided. They have been in use ten years, and, although they are in good order, they may give out at any time.

The parts of the Leavitt pump not sent to Philadelphia have been thoroughly overhauled, the air pump rebored and new piston and valves fitted. The piping has been renewed with brass pipes, and a new injection, connecting directly with the influent pipe of the pump well put in, some changes have been made in the valve motion, so that when complete it will be better than when new, and we may look for an increased duty.

## TUBULAR WELLS.

The low stage of the water in the ponds, in January of this year, made it absolutely necessary that every means of obtaining water should be used, and therefore pumping at the tubular wells was commenced January 23d, and continued twelve hours per day, till April 11th, when the time was increased to twenty-four hours, and has so continued till the present time, with but few interruptions for repairs on the pump and boiler.

The yield from this source was at the rate of 388,191 gallons per day of twenty-four hours.

This yield it was thought could be increased, and authority was obtained from the City Council, August 28th to put down other wells, and a contract was made with Mr. J. C. Coats to put down one 6 inch well, on Bridge street; this was connected with the pump on Boston street by 700 feet of 6 inch pipe. This increased the yield of water to 618,000 gallons when pumping twenty-four hours per day.

The well is 71 feet deep, running down through 58 feet of solid clay and 13 feet of water bearing gravel.

The water remains at the depth of 22 feet from the surface, varying but an inch or two as the pump is run fast or slow. The total amount obtained from the wells is 144,233,861 gallons. A very welcome addition to our water supply.

## DISTRIBUTION PIPE.

There has been laid during the year 20,408 feet of distribution pipe, 4-inch and 6-inch, mostly 6-inch, in 32 streets, including 2,376 feet of 30-inch pipe laid in Birch Pond, and 4,252 feet laid in courts; 45 gates, and 29 hydrants have been put in, including the eight hydrants ordered by City Council, to be put in on the old pipes in the central part of the city, four of which are 8-inch hydrants with independent gates. These were much needed and are a great improvement on the old style of hydrants, and have received the approval of the Board of Fire Engineers.

At a fire that occurred on Myrtle street, there was an insufficient supply of water, and on investigation it was found that when the tubular wells were connected with the Boston street pipe, and thereby shutting it off from the reservoir pressure, no compensating connection was made, so that the whole supply for the district bounded by Summer, Cottage and Myrtle streets was received through the 6-inch pipe on Summer street, after passing through Summer to Boston street, and over the Almshouse hill, a distance of over 7000 feet.

Upon recommendation of the Board a connection was made from the junction of Cottage and Waterhill streets, to Boston street, thus doubling the supply to that section.

and giving greater security against fire. The cost was $550. Ninety-nine leaks have been repaired on distribution pipes; 26 new gate boxes put in to replace those rotted out, and 37 hydrants repaired.

Damages caused by the bursting of the water pipes on Oxford and Summer streets have been paid, amounting to over $1100.00. These damages are liable to occur at any time, and no precaution can be taken to prevent them. All that can be done is to be ready to shut the water off at once as soon as leaks are reported.

### SERVICES.

There has been 547 new services put in the past year, and three in Saugus, which were paid for by the owners of the premises.

Ten old services have been renewed and lowered on account of regrading streets.

Six hundred and sixty new service boxes have been put in to replace rotten ones. The boxes now used are believed to be the best in use, having the advantage of simplicity, durability and economy, costing less than any other in use.

There has been a great deal of trouble experienced, not only in our own city, but in others using cement pipe, caused by the rusting up of the pipe where drilled for the corporation cocks and thus shutting off the supply. This is quite a wide spread evil, and for which no remedy has been devised. The only way is to dig up the corporation and drill the hole out again; this is costly and not entirely satisfactory, as it is only a question of time when it will fill up again and require drilling out. One hundred and eighty-nine services have been treated in this way and the number is still increasing, and will continue to increase for some years to come. There were 73 services frozen last winter that had to be thawed out at the expense of the city.

I would respectfully recommend that a deposit of $2.00

be required of all persons requiring their service pipe thawed out, to be refunded if the fault is from the neglect of the city employees, and retained if caused by the neglect of the owner or occupant of the premises.

The total length of the service pipe put in the past year, is 20,358 feet. The amount received for extra pipe and labor, is $2,029.67.

## METERS.

There has been set in 1883, 22 new meters and two have been discontinued. (*See table in Registrar's Report.*) This part of water service should be very much extended, till every large water consumer in the city should be served by meter. Each building should have but one meter, provided by the city, and for the care and correctness of which the city should be responsible.

There are a great many kinds of meters in use, but the perfect meter is yet in the future. Some there are that register quite correctly, but so retard the flow of water that a larger meter than the capacity of the pipe is required, and so they become costly. Others work well where the water is always cold, but cannot be relied on if the check valve of the boilers they supply are defective. They all require constant watching, and often stop without any apparent cause. There is a wide field for inventors in this direction.

## INSPECTION.

It is universally acknowledged by all who have given thought to the subject, that nothing is so condusive to economy in the use of a water supply, as a rigid and faithful house to house inspection, by competent and honest inspectors, who are fearless in the discharge of their duty, and diligent in prosecuting it.

At the beginning of the year the Board were fortunate in securing such a person, and a rigid inspection has been carried as far as possible in the time given to it.

This question was brought before the public some time since by the Registrar, and for some unaccountable reason but little attention seemed to have been paid to it, and the result of the inspection for the last year shows the actual need of a solution of it.

The city has lost every year more than the salary of a competent person, to say nothing of the large waste of water that would be prevented by such a course.

The receipts from fixtures reported by the Inspector, on which no rates have before been paid, amount to $2,155.00, and in October and November $469 more, which will be collected in April, 1884, and this for but one year, while fixtures on some services have been in use for years, and not been paid for at all.

There have been 94 water-closets, 7 urinals, 23 bath-tubs, 342 faucets, 22 hose cocks, 12 engines and boilers found by the Inspector, bills for which have been presented and partly paid. 46 water-closets, 65 faucets and 1 yard hydrant have been found leaking, and have been repaired by the owners.

## NEW SUPPLY.

The year opened with anything but good prospects for a good year for our water supplies. The light rain-fall of the past year, the great increase of services, and the increase of consumption and waste, made it absolutely necessary to provide an additional supply of water. Soon after the beginning of the year steps were taken by the City Government to obtain authority from the Legislature to take the waters of Saugus River, and Hawkes and Penny Brooks; and after numerous hearings, and general delays, permission was obtained, and the City Council, nittee on Water Supply, caused surveys and o be made by Mr. Ball, of Worcester, and on tember 4th the Board was ordered to construct a tunnel canal tween Saugus river, at Howlett's Dam, and Pond, and by a 30 inch pipe laid through the pond e gate house at end of Breed's Pond to the pumping ion.

This is a complete solution of the vexed water question, nd when completed will give an ample supply of good water for many years, at less expense for construction or land damages than by any other scheme that has been levised. (See map.)

This work was commenced as soon as detailed surveys could be made, and contracts were made with Bond & Byer of Lynn, for the tunnel, and Conrad Juul, of Danvers, for the canal, and have been pushed as fast as possible. The 30 inch pipe through the pond is being laid by employees of the city.

The canal is almost finished. The tunnel is not progressing very satisfactorily, and the pipe through the pond is about half finished, but is being pushed as fast as the weather permits. The whole scheme will probably be finished in time to catch the spring rains and melting snows, and the supply will undoubtedly be ample, and of excellent quality.

Respectfully submitted,

JAMES W. LYON,

*Superintendent.*

Approved in Water Board.

JAMES W. LYON, *Clerk.*

## REPORT OF TEST OF DEANE PUMP.

*To the Lynn Public Water Board:*

Gentlemen: The undersigned, having been appointed by you to test the new Deane Pump, would respectfully report that, having notified the contractors that we would test the pump by a twenty-four hours' trial, on the same conditions as the trial of the Leavitt Pump, and having satisfied ourselves that the capacity of the Deane Pump was fully up to the guaranteed capacity, it only remained to test for the guaranteed duty.

This is a horizontal duplex compound engine and pump of the following dimensions:

| | |
|---|---|
| Diameter of high pressure cylinder . . | 16 inches. |
| " " low " " . . | 30 " |
| Water plunger . . . . . | 17½ " |
| " " piston rod . . . | 3 " |
| Actual length of stroke . . . . . | 1.99 feet. |

The vacuum pump and condenser is of the Independent pattern, "Deane's Patent," of the following dimensions:

| | |
|---|---|
| Steam cylinder . . . . . | 10 inches. |
| Water cylinder . . . . . . | 14 " |
| Length of stroke . . . . . | 18 " |

The steam was supplied from the old boilers, and the contract called for an evaporation equal to 10 lbs. of water for each pound of coal consumed, without any allowance for ashes or cinders, and consequently was the basis adopted.

The water was accurately weighed before being fed to the boilers by an arrangement of casks similar to that used at the test of the Leavitt Engine.

At the commencement of the test the steam was 70 lbs. in the boilers, and this, and the condition of the fires, and hight of water in the boilers, were carefully noted, and at the end of the trial were left in the same condition. Observations were made every thirty minutes during the trial.

te kept at the boilers, with very slight variation, team at the engine, 63 lbs.; Water pressure, erage) 57.13; Gauge to surface of supply reduced to nds, 8; Vacuum gauge, 27.1; Height of water in gauge at boilers, 4.25 inches.

The steam pipe from boiler to engine was 4 inches, and 80 feet long.

| | | | |
|---|---|---|---|
| Area of plunger | = | 240.53 | |
| " less 1-2 of rod | = | 3.53 | |
| Net area | = | | 237 in |
| Water pressure at gauge | | 57.13 lbs | |
| Gauge to supply level | | 8.00 lbs | |
| Allowance for friction | | 1.00 lb | |
| Total pressure | | | 66.13 lbs |
| The counter at 12 M., Nov. 23 | | 114.201 | |
| " " 12 M., Nov. 24 | | 146.939 | |
| Total revolutions in 24 hours | | | 32.738 |
| Multiplied by 4 for total No. of strokes | | 130.952 | |
| This multiplied by 1.99 as the average length of stroke makes the total piston travel | | | 260.594 feet |
| Multiplied by 237, the area of plunger, and by 66.13, the total water pressure, give the work done | | | 4,084,240,197 ft.lb |
| The water in each cask full fed to the boiler weighed | | 493 lbs | |
| Number of casks used | | 134 | |
| Total water fed to boiler | | 66.062 | |
| Less drip from steam pipe | | 727 | |
| Total water fed to engine | | | 65.335 lbs |
| Which at the evaporation of 10 lbs. of water for 1 lb. coal guaranteed, gives the total of coal used | | | 6,533.5 lbs |

$$\frac{4,084,240,197 \text{ foot pound}}{6533.5 \text{ lbs. coal}} \times 100 = 62,512.269 \text{ foot pounds.}$$

For 100 lbs. of coal. Which is the duty developed by the engine during the test, an excess of over 4 per cent. above the duty guaranteed by the contractor.

The boiler evaporated 9.01 lbs. water for 1 lb. coal, which was not of the average quality, which will account for the low evaporation, and the arrangement for weighing the water made it necessary to use water at 51°F instead of 110°F, the usual temperature of the feed.

This test will also test the capacity of the pump.

Area of plunger . . 237 in
Multiplied by length of stroke 23.9 "
Gives total displacement 5664.3 " divided by cubic inches in gallons 231=24.5 gals. per stroke
Multiplied by 4 for revolutions = 98 gals. per revl
Multiplied by No. of revolutions 32738=3198324 gals
Less 4 per cent. lost action = 3060,372 gals
Pumped to reservoir as the capacity of the pump.

Respectfully submitted,

Signed, James W. Lyon, Superintendent.
W. H. Messinger, Engineer.

# TABLE I.

## PUMPING RECORD FOR 1883.

| Date. | Number days pumping | Number hours. | Minutes. | Revolutions. | Number per minute. | Coal Consumed. | | | | | | | Gallons of water pumped into reservo | Average per bbl of co | Head against pump. | Average duty in lbs. water, raised one f high per 100 bbls. coal. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Starting. | Running. | Banking. | Heating. | Total coal. | [illegible] | Per cent. | | | | |
| Month. | Days. | H. | M. | Rev. | M. | Lbs. | Lbs | [illegible] | [illegible]s. | Lbs | [illegible] | [illegible] | G. pum. | Galls | Feet | Pounds. |
| January ........ | 18 | 219 | 12 | 245,100 | 18.63 | 15,550 | 5[illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible]7 | 45,723,405 | 615 8 | 166.48 | 82,222,971 |
| February....... | 19 | 231 | 20 | 258,890 | 18.65 | 14,700 | 6[illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible]2 | 48,295,929 | 573 7 | 166.43 | 84,870,000 |
| March .......... | 19 | 226 | 45 | 254,010 | 18.67 | 15,200 | 6[illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible]3 | 47,405,565 | 544.5 | 165.90 | 78,622,447 |
| April ........... | 17 | 201 | 30 | 224,980 | 18.6 | 14,400 | 59,10[illegible] | [illegible] | | [illegible] | [illegible] | [illegible] | 41,971,019 | 542.5 | 166.30 | 75,210,948 |
| May ............ | 17 | 205 | 30 | 229,550 | 18.61 | 14,500 | 60,250 | 4,200 | | 78,950 | 10,800 | 13.68 | 42,822,552 | 542.4 | 166.50 | 74,911,638 |
| June ........... | 22 | 259 | 35 | 279,130 | 17.92 | 14,800 | 73,300 | 5,700 | | 94,100 | 13,800 | 14.66 | 53,071,701 | 585.4 | 166.70 | 74,247,517 |
| [Leavitt | 8 | 142 | 20 | 153,112 | | 3,500 | 48,000 | 1,200 | | | | | L. | 532 | | 73,652,208 |
| July ..... ...... | 5 Both | 44<br>47 | 10<br>15 | 47,270<br>55,980 | | 3,600 | 32,400 | 1,200 | | 119,710 | 16,700 | 14. | 55,851,572 | 370 | 166.50 | |
| [Deane | 8 | 111 | 50 | 152,484 | | 2,900 | 39,310 | 1,200 | | | | | D. | 3112 | | 43,080,430 |
| DEANE PUMP. | | | | | | | | | | | | | | | | |
| August. ........ | 27 | 460 | 55 | 655,140 | 23. | 8,800 | 158,750 | 3,300 | | 170,850 | 26,585 | 15.5 | 58,045,397 | 344 | 166.60 | 47,029,686 |
| September...... | 22 | 452 | 20 | 524,111 | 23.6 | 11,000 | 122,200 | 4,200 | | 137,400 | 19,150 | 14.9 | 46,436,234 | 338 | 166.17 | 45,409,632 |
| October......... | 22 | 303 | 35 | 429,445 | 23.6 | 13,000 | 101,300 | 4,800 | | 119,100 | 17,520 | 14.7 | 38,161,540 | 326 | 165.20 | 44,457,457 |
| November ...... | 16 | 299 | 05 | 389,556 | 23. | 6,400 | 93,400 | 1,500 | | 105,300 | 16,150 | 15.3 | 32,293,769 | 366 | 166.10 | 48,344,512 |
| December....... | 22 | 426 | 15 | 573,110 | 22.3 | 7,200 | 133,350 | 2,100 | | 142,650 | 19,500 | 12 5 | 53,872,340 | 403 | 166.20 | 52,764,549 |
| Total ........... | 242 | 3,631 | 37 | 4,471,868 | 20.5 | 145550 | 1,107,685 | 47,100 | 4,700 | 1,295735 | 186355 | 14.98 | 564,951023 | 511.4 | 166.26 | 68,686,824 |

# COST OF PUMPING.

| | | |
|---|---|---|
| 1,248.735 pounds of coal, average price per net ton $5,75 | | $345 34 |
| 4,700 pounds of coal for heating, average price per net ton $6,25 | | 13 06 |
| 8 cords of wood at $4.50 | | 36 00 |
| Oil, waste, packing, etc. | | 182 72 |
| Sundries | | 52 24 |
| Repairs on boilers | | 8 66 |
| Wages of engineer and Firemen | | 2,324 56 |
| Total | | $5,842 58 |
| Cost of raising one million gallons to the reservoir | $10 34 | |
| Cost of raising one million gallons one foot high | 0 07$\frac{22}{100}$ | |

# TABLE II.

## CONSUMPTION OF WATER FOR THE YEAR ENDING DECEMBER 31, 1883.

| | Monthly Consumption. | Average consumption per day. | Average increase per day. | Average decrease per day. | Average to each consumer. | Average to each inhabitant. |
|---|---|---|---|---|---|---|
| Month. | Gallons. | Gallons. | Gallons. | Gallons. | Galls. | Galls. |
| January ...... | 48,021,862 | 1,549,092 | 114,427 | | 43. | 34.4 |
| February .... | 44,552,779 | 1,591,170 | 41,078 | | 44.4 | 35. |
| March....... | 48,870,033 | 1,570,000 | | 14,170 | 43.6 | 34. |
| April ...... | 42,212,009 | 1,407,066 | | 170,934 | 39. | 32.2 |
| May ......... | 47,933,204 | 1,546,232 | 139,166 | | 43. | 34.1 |
| June ......... | 48,148,061 | 1,606,135 | 59,403 | | 44.6 | 35.7 |
| July ......... | 55,647,882 | 1,794,899 | 188,764 | | 49.9 | 39.8 |
| August ..... | 58,134,508 | 1,875,306 | 80,407 | | 52. | 41.6 |
| September... | 46,291,440 | 1,543,048 | | 332,258 | 42.8 | 34.2 |
| October ..... | 41,439,112 | 1,369,001 | | 174,047 | 38. | 30.4 |
| November... | 40,831,998 | 1,361,066 | | 7,937 | 37.7 | 30.2 |
| December ... | 46,583,559 | 1,502,598 | 141,532 | | 41.7 | 33.3 |
| To. and Av.. | 568,660,447 | 1,557,974 | | | 42.4 | 33.9 |

# TABLE III.

## WATER IN BREED'S AND BIRCH PONDS, FOR EACH WEEK DURING THE YEAR 1883.

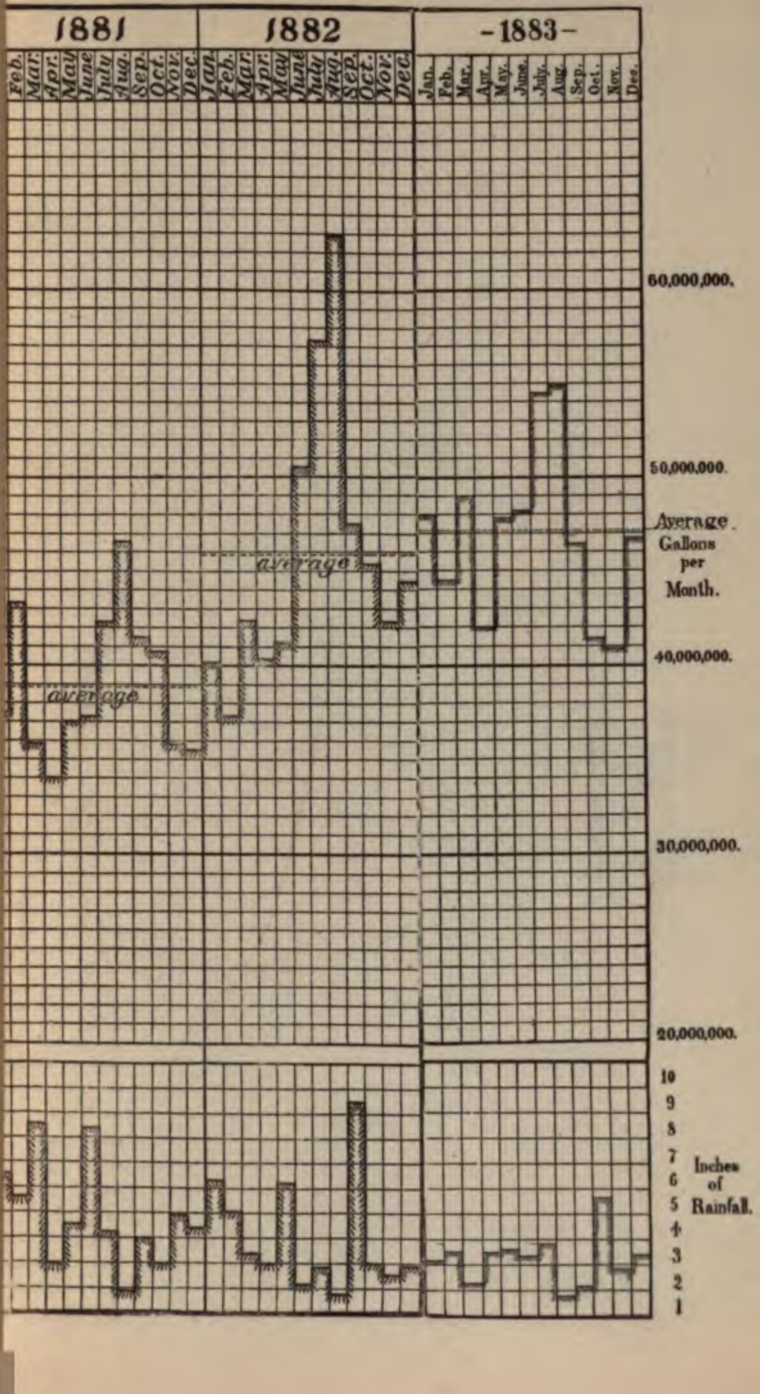
| Date. | Breed's Pond. | | Birch Pond. | | Date. | Breed's Pond. | | Birch Pond. | | Date. | Breed's Pond. | | Birch Pond | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ft. | In | Ft. | In. | | Ft. | In. | Ft. | In. | | Ft. | In. | Ft. | In. |
| Jan. 8 | 10 | 3 | 8 | 9½ | May 7 | 15 | 6 | 9 | 6 | Sept. 3 | 12 | 10 | 6 | 5 |
| " 15 | 10 | 1½ | 8 | 7½ | " 14 | 15 | 3½ | 9 | 6 | " 10 | 12 | | 6 | 3 |
| " 22 | 10 | 2½ | 8 | 8 | " 21 | 15 | 2 | 9 | 5½ | " 17 | 11 | 5½ | 6 | 1 |
| " 29 | 10 | 2½ | 8 | 6 | " 28 | 16 | | 9 | 6 | " 24 | 11 | | 6 | |
| Feb. 5 | 10 | 5 | 8 | 5½ | June 4 | 16 | 2 | 9 | 5 | Oct. 1 | 10 | 7 | 5 | 10½ |
| " 12 | 10 | 8 | 8 | 5½ | " 11 | 16 | 5 | 9 | 0½ | " 8 | 9 | 11½ | 5 | 11 |
| " 19 | 11 | | 8 | 6 | " 18 | 16 | 9 | 8 | 3 | " 15 | 9 | 9 | 5 | 11½ |
| " 26 | 11 | 1½ | 8 | 4 | " 25 | 17 | | 7 | 11½ | " 22 | 9 | 4½ | 6 | |
| Mch. 5 | 11 | 3½ | 8 | 3½ | July 2 | 17 | 3 | 7 | 2 | " 29 | 9 | 2 | 5 | 6 |
| " 12 | 11 | 8½ | 8 | 5 | " 9 | 17 | 1½ | 6 | 11½ | Nov. 5 | 9 | 8½ | 5 | 7 |
| " 19 | 12 | 4 | 8 | 8 | " 16 | 17 | 3 | 6 | 11½ | " 10 | 10 | 2½ | 5 | 2 |
| " 26 | 13 | | 9 | | " 23 | 16 | 1 | 6 | 10½ | " 19 | 10 | 6½ | Wtaer drawn off | |
| Apr. 2 | 13 | 5½ | 8 | 11 | " 30 | 15 | 6 | 6 | 7 | " 26 | 10 | 1½ | | |
| " 9 | 13 | 11 | 9 | | Aug. 6 | 15 | 2 | 6 | 9 | Dec. 3 | 10 | 2 | | |
| " 16 | 14 | 4 | 9 | 3 | " 13 | 14 | 5 | 6 | 6 | " 10 | 9 | 10 | | |
| " 23 | 15 | 1 | 9 | 5 | " 20 | 13 | 11 | 6 | 5 | " 17 | 8 | 10 | | |
| " 30 | 15 | 6 | 9 | 6 | " 27 | 13 | 6½ | 6 | 5½ | " 24 | 8 | 8 | | |
| | | | | | | | | | | " 31 | 8 | 6 | | |

# TABLE IV.

## SHOWING THE RAIN-FALL AT PUMPING STATION FOR 1883.

| MONTH. | | INCHES. |
|---|---|---|
| January | | 2.02 |
| February | | 2.38 |
| March | | 1.46 |
| April | | 2.69 |
| May | | 2.73 |
| June | | 2.03 |
| July | | 2.94 |
| August | | .96 |
| September | | 1.10 |
| October | | 5.82 |
| November | | 1.99 |
| December | | 2.02 |
| Total | | 28.14 |
| Total in 1882 | 36.39 | |
| Difference | 8.25 | |

## , FOR THE LAST 10 YEARS.



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## TABLE V.

SHOWING THE AMOUNT AND SIZE OF PIPE LAID DURING THE YEAR 1883.

| STREETS WHERE LAID. | | | SIZE OF PIPE. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STREET. | FROM. | TO. | 30 | 20 | 14 | 12 | 10 | 8 | 6 | 4 |
| Livingstone | Oakwood | Washburn | | | | | | cement. | 370 | |
| Timson | Empire | To end | | | | | | " | 255 | |
| Empire | Williams | Columbia | | | | | | " | 801 | |
| Neptune | Light | To end | | | | | | " | 435 | 215 |
| Minot | Neptune | Western ave | | | | | | " | 514 | |
| Flint | Boston | Walnut | | | | | | cement. | 1,910 | |
| | | | | | | | | C. I. | 19 | |
| Acorn | High Rock | Hollingsworth | | | | | | cement. | | 561 |
| Mansfield | Boston | To end | | | | | | " | | 417 |
| Hudson | Boston | To end | | | | | | " | | 471 |
| Collins ave | Bowler | Rand | | | | | | " | | 224 |
| French | Chestnut | To end | | | | | | " | | 216 |
| Stetson | Boston | Pevear's factory. | | | | | | C. I. | 385 | |
| Parrott | Fayette | To Chatham | | | | | | cement. | 726 | |
| Williams | | End | | | | | | " | | 231 |
| Western ave | End of pipe | | | | | | | " | 363 | |
| Pine Grove | Tapley | End | | | | | | " | 484 | |
| Woodlawn | End of pipe | End of street | | | | | | " | 289 | |
| Wyman | Boston | Walnut | | | | | | " | 1,905 | |
| | | | | | | | | C. I. | 55 | |
| Beach | | Nahant line | | | | | | " | 560 | |
| Abbott | Waterhill | Woodman | | | | | | cement. | | 648 |
| Holyoke | Myrtle | Nahant | | | | | | | W. I. | 472 |
| Mountain ave | Essex | Swampscott line | | | | | | W. I. | 682 | |
| Rodgers ave | Essex | High Rock | | | | | | " | 937 | |
| Tubular wells | Boston | Pump house | | | | | | | 696 | |
| Cottage | Waterhill | Boston | | | | | | cement. | 52 | |
| | | | | | | | | C. I. | 36 | |
| | | | | | | | | W. I. | 354 | |
| Light | Neptune | Norton | | | | | | cement. | | 257 |
| Norton | | | | | | | | " | | 404 |
| Allen ave | | | | | | | | W. I. | 364 | |
| E. Hollingsworth | | | | | | | | C, I. | 181 | |
| Jefferson | Chestnut | | | | | | | W. I. | 130 | |
| Eastlake | Chatham | | | | | | | C. I. | 253 | |
| Eastern ave | Essex | | | | | | | " | 237 | |
| Columbia | Empire | | | | | | | W. I. | 490 | |
| Michigan ave | New Ocean | | | | | | | " | 168 | |
| Almont | | | | | | | cement. | | | 35 |
| Spring | | | | | | | " | | | 10 |
| State | | | | | | | " | 8 | | |
| Market | | | | | | | " | 31 | | |
| Mulberry | | | | | | | " | | | 10 |
| Central square | | | | | | | " | 29 | | |
| Central ave | | | | | | | " | | 24 | |
| Pumping station | | | C. I. | 52 | 22 | | | | | |
| Birch pond | | C. I. | 2,376 | | | | | | | |
| | | | 2,376 | 52 | 22 | | | 68 | 13,525 | 4,365 |

Total .................... 20,408 feet. 3 miles 4,568 feet.

Total extension in 1883 .................... 4 miles, 3,540 feet.

Previously laid .................... 65 miles, 925 feet.

Total to January 1, 1884 .................... 69 miles, 4,465 feet.

# TABLE VI.

## PIPES LAID IN COURTS IN 1883.

| Name of Court. | Size of Pipe. | | | |
|---|---|---|---|---|
| | 2 | 1 1-2 | 1 1-4 | 1 |
| **South street** | 277.11 | | | |
| **South street court** | | | 135.00 | |
| **Florence street** | | 14.34 | | |
| **South street place** | | 287.4 | | |
| **Church court** | 361.00 | | | |
| **Lakewood avenue** | 118.00<br>Galvanized | | 175.00 | 92. |
| **Valley avenue** | 160.00 | 211.7 | | |
| **Washburn street** | 132.4 | | | |
| **Walnut street** | 314.2 | | | |
| **Summit avenue** | 400.9 | | | |
| **Philpot court** | | 180.10 | | |
| **Morris street** | | 198.8 | | |
| **Myrtle street** | | 142.2 | | |
| **Beacon Hill place** | 277.00 | | | |
| Williams court | | | 178.00 | |
| Railroad court | | 263.00<br>Galvanized | | |
| Landers street | 205.00 | | | |
| Totals. | 224.6 | 1,426.11 | 488.00 | 92,00 |

Total extension in 1883 .......... 4,252 feet.

# TABLE VII.

## LOCATION OF GATES SET IN 1883.

| Street. | Location. | Size Inches. |
|---|---|---|
| Corner Timson and Empire sts...... | 14 feet from N. side of Timson st. and 3 feet from W. side of Empire...................... | 6 |
| Empire and Brookline sts. ......... | On line of Brookline st., 17 feet from E. side of Empire st................................ | 6 |
| Empire and Groveland sts........ | On line of Empire st., 11 feet from N. side of Groveland st............................ | 6 |
| Neptune and Light sts ............. | On line of Light st., 12 feet 6 inches from N. side of Neptune st. .......................... | 4 |
| Minot st. and Western avenue..... | On line of Western ave., 18 feet 3 inches from W. side of Minot st..................... | 6 |
| Flint and Boston sts ............. | On line of Boston st., 37 feet from W. line of Flint st.................................... | 6 |
| Flint and Walnut sts.............. | On line of Walnut st., 17 feet 8 inches from E. side of Flint st. ........................ | 6 |
| Mansfield and Boston sts.......... | On line of Boston st., 35 feet from N. side of Mansfield st................................ | 4 |
| Hudson and Boston sts.......... | On line of Boston st., 30 feet from W. side of Hudson st. ................................. | 4 |
| Stetson and Boston sts.............. | On line of Boston st., 13 feet 8 inches from S. line of Boston st. ......................... | 6 |
| Parrott and Fayette sts............... | On line of Fayette st., 12 feet from S. line of Parrott st.................................... | 6 |
| Parrott and Chatham sts......... | On line of Chatham st., 14 feet from S. line of Parrott st................................ | 6 |
| Collins ave. and Rand st......... | On line of Collins avenue 15 feet from S. line of Rand st.......................... .......... | 4 |
| Pine Grove and Tapley sts....... | On line of E. side of Tapley st., 15 feet from S. line of Pine Grove st........................ | 6 |
| Wyman and Boston sts.......... | On line of Boston st., 18 feet from E. line of Wyman st. ................................. | 6 |
| Wyman and Walnut sts.......... | On line of Walnut st., 15 feet from E. side of Wyman st. ................................ | 6 |
| Waterhill and Abbott sts......... | On line of Waterhill st., seventeen feet from E. side of Abbott st......................... | 4 |
| Abbott and Woodman sts......... | On line of Woodman st., fifteen feet from E. side of Abbott st............................ | 4 |
| Beach st......... | On line of E. side of fountain, 4 feet S. of fountain.................................... | 6 |
| Mountain ave. and Essex st......... | On line of Essex st., 12 feet from E. side of Mountain ave................................ | 6 |
| Rogers avenue and Essex st......... | On line of Essex st., 15 feet from W. side of Roger ave. .................................. | 6 |

## TABLE VII.—Continued.

### LOCATION OF GATES SET IN 1883.

| Street. | Location. | Size. Inches. |
|---|---|---|
| Light and Neptune sts | On line of S. side of Neptune st., 17 feet from E. side of Light st. | 4 |
| Cottage and Boston sts | On line of Boston st., 16 feet from easterly side of Cottage st. | 6 |
| Columbia and Empire sts. | On line of Empire st., 15 feet from Northerly side of Columbia ave. | 6 |
| Brookline and Empire sts. | On line of Brookline st., 15 feet from E. line of Empire. | 6 |
| Eastern ave. and Essex sts. | On Northerly line of Essex st., 16 feet from E. line of Eastern ave. | 6 |
| Eastlake and Chatham sts. | On line of Chatham st., 15 feet from N. side of Eastlake. | 6 |
| Oak st. | 6 feet W. from 12 feet gate. | |

| | |
|---|---|
| Number of gates set in 1883 | 47 |
| Number of gates previously set | 501 |
| Total number of gates set to 1884 | 548 |

## TABLE VII.—Continued.

### GATES SET IN COURTS IN 1883.

| Street. | Location. | Size Inches. |
|---|---|---|
| Corner South and Neptune | On the line of Neptune st., 17 feet 8 inches from W. line of South st. | 2 |
| Florence and Gardner | On line of Gardner st., 14 feet 6 inches from N. line of Florence st. | 1½ |
| South st. and South st. court | On line of South st., 12 feet 10 inches from N. line of South st. place | 1½ |
| Church court and Boston st | On line of Boston st., 7 feet from N. line of Church court | 2 |
| Lakewood st. | On line of Lake st., 11 feet 6 inches from W. line of Lakewood st. | 2 |
| Valley ave and High Rock st. | On line of High Rock st., 18 feet 6 inches from E. side of Valley avenue | 2 |
| Washburn & Clinton st | On line of Clinton st., 16 feet from N. line of Washburn court | 2 |
| Walnut and Holyoke sts | On line of Walnut st., 14 feet 6 inches from S. side of Walnut st. | 2 |
| Summit ave. and Mountain ave. | On line of Mountain ave., 15 feet from South st. and Summit ave. | 2 |
| Philpot court and Fremont st. | On line of Fremont st., 12 feet from N. line of Philpot court | 1½ |
| Maurice court and Cottage st. | On line of Cottage st., 17 feet three inches from S. line of Morris court | 1½ |
| Williams court and Boston st. | On line of Boston st., 8 feet from W. side of Williams court | 1¼ |
| Beacon Hill place and Allen ave. | On line of Allen ave., 12 feet from S. line of Beacon Hill place | 2 |
| Livingston st. and Oakwood ave. | On line of Oakwood ave., 15 feet from W. line of Livingston st. | 4 |
| Acorn st. and High Rock st. | On line of High Rock st., 22 feet from E. line of Acorn st. | 4 |
| Jefferson st. and Chestnut st. | On line of Chestnut st., 15 feet from S. line of Jefferson st. | 6 |
| Allen and Henry avenues | On line of Henry ave., 15 feet from S. line of Allen avenue | 6 |
| Tubular Well. | On E. side of pump house, 20 feet gate at pumping station, 20 feet 4 inches from W. abutment of st. | 6 |

## TABLE VIII.

### SHOWING THE NUMBER AND LOCATION OF HYDRANTS SET IN 1883.

| Street. | Location. |
|---|---|
| Minot | 25 feet from Neptune street |
| Flint | 350 feet from Boston street |
| Flint | 700 feet from Boston |
| Flint | 400 feet from Walnut street |
| Flint | 750 feet from Walnut street |
| Mansfield | at end of pipe |
| Hudson | at end of pipe |
| Stetson | at Pevear's factory |
| Parrott | at school house |
| Western avenue | at No. 132 |
| Pine Grove avenue | at end of pipe |
| Woodlawn | at end of pipe |
| Wyman | 400 feet from Boston street |
| Wyman | 700 feet from Boston street |
| Wyman | 300 feet from Walnut street |
| Wyman | 700 feet from Walnut street |
| Beach | at Nahant line |
| Mountain avenue | at Swampscott line |
| Mulberry | at centre |
| Almont | at centre |
| Central avenue | corner Sutton street |
| Central square | at gate house |
| State | corner Brown street |
| Market | at line of Nos. 26 and 28 |
| Broad | at No. 150 |
| Spring | at centre |
| Columbia | at end of pipe |
| Norton | at end of pipe |
| Oak | at angle |

| | |
|---|---|
| Number of Hydrants set in 1883 | 29 |
| Previously set | 498 |
| Number of Hydrants set to Jan. 1. 1884 | 527 |

# TABLE IX.

## SHOWING THE NUMBER, SIZE AND LENGTH OF SERVICE PUT IN IN 1883.

| Month. | Size and Length of Pipe. | | | | | | | | | | Total. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 inch. | | 1 1-2 inch. | | 1 1-4 inch. | | 1 inch. | | 3-4 inch. | | | |
| | No. | Length. | No. | Length. | No. | Length. | No. | Length. | No. | Length. | No. | Length |
| January | | | | | | | | | | | | |
| February | | | | | | | | | | | | |
| March | | | | | | | | | | | | |
| April | | | | | 1 | 55.10 | 10 | 328.00 | 23 | 743.06 | 34 | 1,129.04 |
| May | 1 | 21.04 | | | 3 | 238.08 | 5 | 257.03 | 48 | 1,526.09 | 57 | 204.04 |
| June | | | | | | | 13 | 743.02 | 46 | 1,470.00 | 59 | 2.213.02 |
| July | 1 | 46.03 | | | | | 16 | 532.00 | 37 | 1,437.02 | 54 | 2,015.05 |
| August | | | | | 1 | 33.05 | 7 | 348.05 | 88 | 3,106.00 | 96 | 3,487.10 |
| September | 2 | 125.04 | | | | | 9 | 422.09 | 59 | 2,623.10 | 70 | 3,171.11 |
| October | | | | | | | 14 | 469.09 | 53 | 1,702.10 | 67 | 2,172.07 |
| November | 1 | 45.02 | | | | | 4 | 216.00 | 74 | 2,553.00 | 79 | 2,814.02 |
| December | 2 | 134,05 | | | | | 3 | 223.05 | 26 | 254.00 | 31 | 1,311.10 |
| Totals | | 372.05 | | | | | 81 | 3,539.09 | 454 | 1,611.07 | 547 | 20,358,04 |

# TABLE X.

## REPAIRS OF PIPES, GATES AND HYDRANTS IN 1883.

| Month. | Size of Pipes. | | | | | | | | | | | Size of Gates. | | | | | | Hydrants. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 16 | 12 | 10 | 8 | 6 | 4 | 2 | 1½ | 1¼ | 1 | ¾ | 16 | 12 | 10 | 8 | 6 | 4 | |
| January | | | | | | | | | | | | | | | | | | |
| February | 1 | | | 3 | 1 | 2 | | | | | 3 | | | | | | | 1 |
| March | | 1 | | | 7 | 1 | | | | | 1 | | | | | | | 4 |
| April | | | | 1 | 2 | | | | | | | | | | | | | 6 |
| May | | | | 1 | 2 | | | | | | 1 | | | | | | | 6 |
| June | | | | | 8 | 5 | | | | | 1 | | | | | | | 2 |
| July | | | | | 12 | 9 | | | | | 2 | | | | | | | 1 |
| August | | 1 | | | 9 | | | | 1 | | | | | | | | | 1 |
| September | | | | | 3 | 2 | | | | 1 | | | | | | | | 1 |
| October | | | | | 5 | 2 | | | | | | | | | | | | 12 |
| November | | 1 | | 1 | 7 | 3 | | | | | | | | | | | | 3 |
| December | | | | | 2 | | | | | | | | | | | | | |
| Total 1883 | 1 | 3 | | 6 | 58 | 24 | | | | 1 | 8 | | | | | | | 37 |
| Total 1882 | 3 | 1 | | 10 | 57 | 44 | | | | 7 | 9 | | | | | | | |
| Decrease | 2 | | | 4 | 1 | 20 | | | | 6 | 1 | | | | | | | |

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